(Total No. of printed pages : 24)

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(CPG–EE–2017)

Subject : MATHEMATICS

Code **A**

Sr. No. 10125

SET–"A"

Time : 1½ Hours **Total Questions : 100** **Max. Marks : 100**

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

Name : _____ Date of Birth : _____

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24/6/17 24/6/17

Question No.	Questions
1.	If matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$, then A^2 is equal to (1) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} -1 & -2 & -3 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$
2.	If $A = \begin{bmatrix} 0 & 4 & -2 \\ x & 0 & -y \\ 2 & -8 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then $x - y =$ ..... is (1) 8 (2) 4 (3) -12 (4) -8
3.	if $3x + 2y + z = 0$; $x + 4y + z = 0$; $2x + y + 4z = 0$, be a system of equations, then (1) It is inconsistent (2) It can be reduced to a single equation and so a solution does not exist. (3) It has only the trivial solution $x = 0, y = 0, z = 0$ (4) The determinant of the matrix of coefficient is zero.

Question No.	Questions
4.	The condition that the cubic equation $x^3 - px^2 + qx - r = 0$ has all of its three roots equal is given by (1) $p^2 = 3qr$ (2) $q^2 = 3pr$ (3) $r^2 = 3pq$ (4) None of these
5.	Which of the following is not correct ? (1) Every square matrix satisfies its own characteristic equation. (2) If λ is an eigen-value of a matrix A, then $\frac{1}{\lambda}$ is the eigen-value of the matrix A^{-1}. (3) The sum of the eigen-values of a matrix is equal to the sum of elements of principal diagonal. (4) The matrices A and A^T have different eigen-values.
6.	Which of the following function f (x) is differentiable at the origin : (1) $f(x) = \lvert x \rvert$ (2) $f(x) = x^{2/3}$ (3) $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ (4) $f(x) = e^{-1/x^2}$
7.	The curve $2x^2 - 3xy - 2y^2 = 1$ has two asymptotes that are (1) Perpendicular (2) Parallel (3) Intersect at an angle 60° (4) None of these

Question No.	Questions
8.	The radius of curvature of the curve $y = e^x$ at the point where it crosses the y-axis is (1) 2 (2) $\frac{\sqrt{2}}{2}$ (3) $2\sqrt{2}$ (4) $\sqrt{2}$
9.	For the curve $y^2(1+x) = x^2(1-x)$, the origin is a (1) Cusp (2) Point of inflexion (3) Node (4) None of these
10.	The area of surface of the solid generated by the revolution of the line segment $y = 2x$ from $x = 0$ to $x = 2$, about x-axis is equal to (1) $\pi\sqrt{5}$ (2) $2\pi\sqrt{5}$ (3) $4\pi\sqrt{5}$ (4) $8\pi\sqrt{5}$
11.	The centre of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) $(2, -3, 4)$ (2) $(-2, 3, -4)$ (3) $(-4, 6, -8)$ (4) $(4, -6, 8)$
12.	The equation of the right circular cone whose axis is $x = y = z$, vertex is the origin and the semi-vertical angle is $45°$ is given by (1) $(x^2 + y^2 + z^2) = 3(x + y + z)^2$ (2) $2(x + y + z)^2 = 21(x^2 + y^2 + z^2)$ (3) $3(x^2 + y^2 + z^2) = 2(x + y + z)^2$ (4) $x^2 + y^2 + z^2 = \frac{1}{2}$

Question No.	Questions
13.	The equation of the cylinder, whose generators are parallel to the line $\frac{x}{1}=\frac{y}{-2}=\frac{z}{3}$ and whose guiding curve is the ellipse $x^2 + 2y^2 = 1$, $z = 0$ is given by (1) $(3z - x)^2 + 2(2z + 3y)^2 = 9$ (2) $(3x - z)^2 + 2(3y + 2z)^2 = 9$ (3) $(3x + z)^2 + 2(3y - 2z)^2 = 9$ (4) None of these
14.	The equation of the tangent to the parabola $y^2 + 4y + 20x = 0$ at (0, 0) is (1) $y = 2x$ (2) $y = 5x$ (3) $x - 5y = 0$ (4) $y + 5x = 0$
15.	The equation $\frac{x^2}{a^2}-\frac{y^2}{b^2}=\frac{2z}{c}$, represents (1) Hyperboloid of one sheet (2) Elliptic Paraboloid (3) Hyperbolic Paraboloid (4) Ellipsoid
16.	$(n^7 - n)$ is divisible by (1) 1 (2) 7 (3) 30 (4) 42
17.	Congruence $33x \equiv 22 \pmod{11}$ has (1) 3 solutions (2) 11 solutions (3) 6 solutions (4) 9 solutions
18.	If p is a prime number and 'a' denotes an integer such that (a, p) = 1, then $a^{p-1} \equiv 1 \pmod{p}$ is known as (1) Fermat's Theorem (2) Wilson's Theorem (3) Chinese Remainder Theorem (4) None of these

Question No.	Questions
19.	The value of $\frac{(\cos\theta + i\sin\theta)^6}{(\cos\theta - i\sin\theta)^4}$ is (1) 1 (2) 0 (3) $\cos 10\theta + i \sin 10\theta$ (4) $\cos 2\theta + i \sin 2\theta$
20.	Which is not correct ? (1) $\sin(ix) = i \sinh x$ (2) $\text{sech}\,\theta = \frac{2}{e^{\theta} - e^{-\theta}}$ (3) $\tanh\theta = \frac{e^{\theta} - e^{-\theta}}{e^{\theta} + e^{-\theta}}$ (4) $\cosh^2 x - \sinh^2 x = 1$
21.	Solution of differential equation $(y - px)^2 = 1 + p^2$, is (1) $y = cx^2 + \sqrt{1-p^2}$ (2) $y = px + \sqrt{1+p^2}$ (3) $y = px - \tan^{-1} c$ (4) $y = cx + \sqrt{1+c^2}$, is constant
22.	P dx + x sin y dy = 0 is exact, then P can be (1) sin y + cos y (2) – sin y (3) $x^2 - \cos y$ (4) cos y
23.	The general solution of the differential equation $(D^2 + 6D + 9)\, y = 5\, e^{2x}$ is (1) $y = (c_1 + c_2 x)\, e^{3x} + 5\, e^{2x}$ (2) $y = (c_1 + c_2 x)\, e^{-3x} + \frac{1}{5} e^{2x}$ (3) $y = (c_1 + c_2 x)\, e^{-3x} + e^{2x}$ (4) $y = (c_1 + c_2 x)\, e^{3x} + \frac{e^{2x}}{3}$

Question No.	Questions
24.	The solution of the differential equation $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 0$ is (1) $y = (c_1 + c_2 \log x)\, x^2$ (2) $y = (c_1 + c_2 x)\, e^{2x}$ (3) $y = c_1 x^2 + \frac{c_2}{x}$ (4) $y = (c_1 + c_2 x)\, e^{-x}$
25.	The orthogonal trajectory of family of curves $y = ax^2$ is (1) $x^2 + y^2 = a^2$ (2) $x^2 + 2y^2 = a^2$ (3) $2x^2 + y^2 = a^2$ (4) $\frac{x^2}{a^2} - \frac{y^2}{a^2} = 1$
26.	If the vectors $2\hat{i} - \hat{j} + \hat{k}$; $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ be coplanar, then the value of a is given by (1) 1 (2) -2 (3) -3 (4) -4
27.	The value of λ so that the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector, is given by (1) 2 (2) 3 (3) -2 (4) 1
28.	Which is not correct ? (Here r, θ, z are cylindrical coordinates and $\hat{e}_r, \hat{e}_\theta, \hat{e}_z$ are unit vectors in these coordinates), (1) $\frac{d}{dt}\hat{e}_r = \dot{\theta}\,\hat{e}_\theta$ (2) $\frac{d}{dt}\hat{e}_\theta = -\dot{\theta}\,\hat{e}_r$ (3) $\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$ (4) $\hat{e}_\theta = \cos\theta\,\hat{i} - \sin\theta\,\hat{j}$

Question No.	Questions
29.	If $\vec{R} = x\hat{i} + y\hat{j} + z\hat{k}$, and if S is closed surface enclosing a volume V, where $\hat{n}$ is the outward drawn unit-normal vector to the surface S, then $\iint_S \vec{R} \cdot \hat{n}\, dS$ is equal to (1) 4V (2) 3V (3) 2V (4) V
30.	Stoke's theorem is a relation between (1) Line integral and Surface integral (2) Line integral and Volume integral (3) Surface integral and Volume integral (4) None of these
31.	If $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$, then the value of $\frac{dy}{dx}$ will be (1) $\tan\frac{\theta}{2}$ (2) $\tan\theta$ (3) $\cot\frac{\theta}{2}$ (4) $\cot\theta$
32.	Let $f(x) = \sqrt{x^2 - 4}$, $x \in [2, 4]$, then which of the following is true for f (x) ? (1) Roll's Theorem is applicable (2) Lagrange's Mean Value Theorem is applicable (3) There exists at least one $C = 2\sqrt{3}$ in (2, 4) (4) All the above are true.

Question No.	Questions
33.	$\lim_{a \to b} \frac{a^b - b^a}{a^a - b^b}$ is (1) $\frac{1 - \log b}{1 + \log b}$ (2) $\frac{1 - \log b}{1 + \log a}$ (3) $\log \frac{a}{b}$ (4) None of these
34.	If $u = \log\left(\frac{x^2 + y^2}{x + y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to (1) 0 (2) u (3) 1 (4) e^u
35.	Which is not correct ? (where symbols have their usual meanings in differential geometry). (1) $\frac{d\vec{t}}{ds} = k\vec{n}$ (2) $\frac{d\vec{b}}{ds} = -\tau\vec{n}$ (3) $\frac{d\vec{n}}{ds} = \tau\vec{b} - k\vec{t}$ (4) $\vec{r}' . \vec{r}''' = k^2$
36.	The particular integral of $(D^2 - 2DD')z = \sin(x + 2y)$ is (1) $\frac{1}{6}\sin(x + 2y)$ (2) $\frac{1}{3}\sin(x + 2y)$ (3) $\frac{1}{6}\cos(x + 2y)$ (4) None of these

Question No.	Questions
37.	The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x\,\partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is (1) Parabolic (2) Hyperbolic (3) Elliptic (4) None of these
38.	The characteristic equations of $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x\,\partial y} - 8\frac{\partial^2 u}{\partial y^2} = 0$ are given by (1) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} - 4 = 0$ (2) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} + 4 = 0$ (3) $dy + 2\,dx = 0$ and $dy - 4\,dx = 0$ (4) None of these
39.	The equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$ is called (1) One dimensional heat equation (2) Two dimensional heat equation (3) Two dimensional wave equation (4) Laplace equation
40.	Solution of $yp - xq = y^2 - x^2$ is (1) $\phi(x^2 + y^2, xy - z) = 0$ (2) $\phi(xy, x^2 + y^2 + z^2) = 0$ (3) $\phi\left(\frac{1}{x} - \frac{1}{y}, \frac{x-y}{z}\right) = 0$ (4) None of these

Question No.	Questions
41.	The resultant of two forces P and Q act at right angles to P, the angle between the forces is (1) $\cos^{-1}\left(-\frac{P}{Q}\right)$ (2) $\tan^{-1}\left(-\frac{P}{Q}\right)$ (3) $\sin^{-1}\left(-\frac{Q}{P}\right)$ (4) $\cos^{-1}\left(\frac{P}{Q}\right)$
42.	Three forces 2P, 3P and 4P act at a point in direction parallel to the sides of an equilateral triangle taken in order. Magnitude of the resultant is (1) 3P (2) 2P (3) $\sqrt{17}$ P (4) $\sqrt{3}$ P
43.	If the normal reaction is 10 units and limiting friction is 5 units, then the coefficient of friction is (1) 2 (2) $\frac{2}{3}$ (3) $\frac{1}{2}$ (4) None of these
44.	Suppose a system of forces is reduced to a single force $\vec{R}$ and a Couple of moment $\vec{k}$ whose axis coincides with the direction of acting force, then $\vec{R}$ and $\vec{k}$ taken together are called (1) Null line (2) Wrench (3) Pitch (4) None of these

Question No.	Questions
45.	The condition that the straight line $\frac{x-f}{\ell}=\frac{y-g}{m}=\frac{z-h}{n}$ may be a null line for the system of forces (X, Y, Z ; L, M, N) is (1) $\begin{vmatrix} X & Y & Z \\ \ell & m & n \\ f & g & h \end{vmatrix} = L\ell + Mm + Nn$ (2) $\begin{vmatrix} x & y & z \\ \ell & m & n \\ X & Y & Z \end{vmatrix} = -(L\ell + Mm + Nn)$ (3) $Lx + My + Nz = 0$ (4) None of these
46.	The greatest lower bound of $\left\{\left(1+\frac{1}{n}\right)^n\right\}$ is (1) 0 (2) 2 (3) 1 (4) None of these
47.	The sequence $\left\{\frac{2n-7}{3n+2}\right\}$ is (1) Monotonic increasing, and is bounded. (2) Monotonic decreasing, and is bounded. (3) Monotonic increasing and is not bounded. (4) Monotonic decreasing and is not bounded.

Question No.	Questions
48.	The series whose n^{th} term is $\left(\sqrt{n^3+1}-\sqrt{n^3}\right)$ is (1) Divergent (2) Convergent (3) Oscillatory (4) None of these
49.	If $\sum u_n$ is a series of positive terms and if $\lim_{n\to\infty}(u_n)^{1/n}=\ell$, then the series is divergent if (1) $\ell > 1$ (2) $\ell < 1$ (3) $\ell \leq 1$ (4) None of these
50.	"A series obtained from an absolutely convergent series by a rearrangement of terms converges absolutely and has the same sum as the original series", is statement of a theorem known as (1) Riemann's rearrangement theorem (2) Dirichlet's theorem (3) Pringsheim's theorem (4) Cauchy's theorem
51.	The value of Bessel's function $J_{1/2}(x)$ is given by (1) $\sqrt{\frac{2}{\pi x}}\sin x$ (2) $\sqrt{\frac{2}{\pi x}}\cos x$ (3) $\sqrt{\frac{\pi x}{2}}\sin x$ (4) None of these
52.	If $P_n(x)$ is Legendre polynomial, then which of the following is not correct ? (1) $P_0(x)=1$ (2) $P_1(x)=x$ (3) $P_n(-x)=(-1)^n P_n(x)$ (4) None of these

Question No.	Questions
53.	The value of $\int_{-1}^{+1} P_n^2(x)\,dx$ is equal to (1) 0 (2) $\frac{2}{2n+1}$ (3) $\frac{2}{n+1}$ (4) 1
54.	Inverse Laplace transform of $\left[\frac{s^2-a^2}{(s^2+a^2)^2}\right]$ is (1) t sin at (2) t cosh at (3) t cos at (4) t sinh at
55.	If $F_s(s)$ and $F_c(s)$ are Fourier sine and cosine transforms of f(t), respectively, then which is correct ? (1) $F_s[f(t)\cos at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (2) $F_s[f(t)\cos at] = \frac{1}{2}[F_c(s+a) + F_c(s-a)]$ (3) $F_s[f(t)\sin at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (4) None of these
56.	Which of the following symbols in C – Language represents logical operator ? (1) == (2) && (3) % (4) >=

Question No.	Questions
57.	The purpose of strrev ( ) function in C – Language is to (1) Compare two strings (2) Find length of a string (3) Reverse the string (4) Copy one string over the other.
58.	Which of the following is an unconditional control transfer statement ? (1) if statement (2) goto statement (3) if-else statement (4) switch statement

59.	Which of the following statement is incorrect ?
	(1) while (condition) {
	statement(s) ;
	}
	(2) do {
	statement(s) ;
	} while (condition) ;
	(3) switch (expression)
	{
	case exp 1 :
	statement block-1
	break ;
	case exp 2 :
	statement block-2
	break ;
	--------- 	
	--------- 	
	default :
	default block
	}
	statement t ;
	(4) None of these

Question No.	Questions
60.	To send the value of variable using pointers is known as (1) Recursion (2) Call by reference (3) Getw function (4) None of these
61.	If a function f be bounded on [a, b], then (1) f is necessarily R-integrable (2) f is R-integrable if $[a, b] \subset N$ (3) f is not necessarily R-integrable (4) f is R-integrable if $[a, b] = N \cup \phi$
62.	If f be a monotonic function, then (1) f be R-integrable (2) f be R-integrable if $f \neq 0$ (3) f be bounded (4) All the above
63.	If f is integrable on [a, b] and F is the primitive of f on [a, b], then $\int_a^b f\,dx = F(b) - F(a)$ is statement of (1) First Mean Value theorem (2) Fundamental theorem of integral calculus (3) Baire's Category theorem (4) None of these
64.	The integral $\int_0^{\pi/2} \frac{\sin x}{x^n}\,dx$ converges if (1) $n < 1$ (2) $n > 1$ (3) $n > 2$ (4) $n < 2$

Question No.	Questions
65.	If on a non-empty set X, $d : X \times X \to R$ be a function such that $d(x, y) = \begin{cases} 0 \text{ if } x = y \\ 1 \text{ if } x \neq y \end{cases}$, then (1) (X, d) is a semi-metric space (2) (X, d) is a metric-space (3) (X, d) is not a metric-space (4) None of these
66.	The derived set for the set $S = \left\{\frac{1}{n}; n \in N\right\}$ is (1) R (2) N (3) {0} (4) {0, ∞}
67.	The statement "Every complete metric space is of the second category as a subset of itself" refers to (1) Baire's Category Theorem (2) Cantor's intersection Theorem (3) Bolzano-Weierstrass property (4) None of these
68.	The set $G = \{1, w, w^2\}$, where w is a cube root of unity, with respect to multiplication is a (1) Group (2) Abelian group (3) Cyclic group (4) All of these
69.	If H and K are two non-empty subsets of abelian group G, then HK is a subgroup of G if (1) H is a subgroup of G (2) K is a subgroup of G (3) $H \cap K$ is subgroup of G (4) H as well as K are subgroups of G.

Question No.	Questions
70.	If p is a prime, then any group G of order 2p has (1) a normal subgroup of order p (2) a normal subgroup of order 2p (3) a normal subgroup of order p^2 (4) None of these
71.	Cayley's theorem states that (1) Every finite group is isomorphic to a permutation group (2) Every finite group is isomorphic to a quotient group (3) Every subgroup of a cyclic group is cyclic (4) The order of each subgroup of a finite group is a divisor of the order of the group.
72.	The ring of even integers is also a (1) Field (2) Integral domain (3) Division ring (4) Commutative ring
73.	A division ring has at least ..... elements. (1) 1 (2) 2 (3) 3 (4) None of these
74.	The number of trivial subgroups of a cyclic group of order 8 is (1) 0 (2) 1 (3) 2 (4) 3

Question No.	Questions
75.	The transverse component of acceleration is given by (1) $\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$ (2) $\frac{d^2r}{dt^2}-r\left(\frac{d\theta}{dt}\right)^2$ (3) $\frac{d^2r}{dt^2}+r\left(\frac{d\theta}{dt}\right)^2$ (4) $r\frac{d^2\theta}{dt^2}-2\frac{dr}{dt}\frac{d\theta}{dt}$
76.	A particle executing a S.H.M. has acceleration 8 cm/sec^2 when it is at a distance 2 cm from the centre. The time period will be (1) $\frac{2}{\pi}$ sec. (2) $\frac{1}{\pi}$ sec. (3) $\frac{\pi}{2}$ sec. (4) π sec.
77.	A man while going on a scooter with a speed of 10 m/sec, a child on the road and brings the scooter to stop, 4 seconds just in time to save the child. If the weight of the scooter together with the man is 200 kg, what retarding force was applied on the scooter ? (1) 300 N (2) 400 N (3) 500 N (4) 600 N
78.	If the greatest height attained by a projectile be equal to the horizontal range, then the angle of projection is given by (1) $\tan^{-1}\left(\frac{1}{4}\right)$ (2) $\tan^{-1}4$ (3) $\tan^{-1}2$ (4) $\tan^{-1}\left(\frac{1}{2}\right)$

Question No.	Questions
79.	The differential equation of a central orbit under P as central force per unit mass, in polar form is given by : (Here $u = 1/r$ and h is constant). (1) $P = h^2 u^2 \left[u + \frac{d^2u}{d\theta^2}\right]$ (2) $P = h^2 u^2 \left[u + \left(\frac{du}{d\theta}\right)^2\right]$ (3) $P = h^2 \left[u^2 + \left(\frac{du}{d\theta}\right)^2\right]$ (4) None of these
80.	Which is not correct ? (1) Relative to the sun, the planets describe ellipses with the sun as one focus. (2) The radius vector drawn from the sun to a planet sweeps out areas at a constant rate (3) The square of the periodic times are proportional to the semi-major axis of the elliptic orbits and hence also to the mean distances from the sun. (4) If a particle moves under the action of a conservative system of forces, the sum of its kinetic and potential energies remain constant throughout the motion.
81.	If $u = x + y$, and $v = (x + y)^2$, then value of $\frac{\partial(u, v)}{\partial(x, y)}$ is (1) 0 (2) $4(x + y)^2$ (3) x (4) $\frac{1}{x}$
82.	The value of Beta function $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$ is (1) $\sqrt{2\pi}$ (2) $\pi\sqrt{2}$ (3) $\sqrt{\pi}$ (4) π

Question No.	Questions
83.	The area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is given by (1) πab (2) $2\pi ab$ (3) $\pi a^2 b$ (4) πab^2
84.	The Fourier series for the function $f(x) = \lvert x \rvert, -\pi \le x \le \pi$ contains (1) only sine terms (2) only cosine terms (3) both sine and cosine terms (4) None of these
85.	The Harmonic conjugate of $u(x, y) = \frac{y}{x^2+y^2}$ is (1) $\frac{x}{x^2+y^2}$ (2) $\frac{-x}{x^2+y^2}$ (3) $\frac{1}{x^2+y^2}$ (4) x^2-y^2
86.	The fixed points of the mapping $w = \frac{(5Z+4)}{(Z+5)}$ are (1) 2, 2 (2) –2, –2 (3) 2, –2 (4) None of these
87.	The bilinear transformation that maps the points $z = \infty$, i, 0 into the points $w = 0$, i and ∞ is given by (1) $w = z$ (2) $w = -z$ (3) $w = \frac{1}{z}$ (4) $w = -\frac{1}{z}$

Question No.	Questions
88.	For a non-empty subset W of a vector space V(F), which of the following is incorrect ? (1) W be subspace if $u - v \in W$, $a u \in W$ for $u, v \in W$, $a \in F$ (2) W be subspace iff $au + bv \in W$ for $u, v \in W$; $a, b \in F$ (3) The union of any two subspaces of V(F) is a subspace (4) None of these
89.	Which of the following set form the basis of R^3 : (1) {(2, 3, 1), (7, – 6, 17), (5, 2, 7)} (2) {(2, 1, 4), (1, –1, 2), (3, 1, –2)} (3) {(1, –1, 3), (1, 2, –3), (1, 0, 1)} (4) None of these
90.	Which of the following functions T from $V_2(R)$ into $V_2(R)$ is not a linear transformation ? (1) $T(x, y) = (y, x)$ (2) $T(x, y) = (x + y, x)$ (3) $T(x, y) = (x - y, y - x)$ (4) $T(x, y) = (1 + x, y)$
91.	With respect to standard basis vectors, a linear transformation $T : I R^4 \to IR^3$ is given by the matrix $\begin{bmatrix} 3 & -1 & -1 & 1 \\ -2 & 2 & -2 & -2 \\ -1 & 1 & 3 & -1 \end{bmatrix}$ The dimension of Ker (T) is (1) 1 (2) 2 (3) 3 (4) 4
92.	The norm of x with respect to inner product space $< x, x >$ is given by (1) $\|\|x\|\| = < x, x >$ (2) $\|\|x\|\| = < x, x >^2$ (3) $\|\|x\|\|^2 = < x, x >$ (4) None of these

Question No.	Questions
93.	Let $T : R^n \rightarrow R^n$ be a linear transformation. Which of the following statements implies that T is bijective ? (1) Rank (T) – Nullity (T) = n (2) Rank (T) + Nullity (T) = n (3) Rank (T) = Nullity (T) = n (4) None of these
94.	Let V be an inner product space, then $\lvert < u, v > \rvert \leq \lvert\lvert u \rvert\rvert . \lvert\lvert v \rvert\rvert$ for all $u, v \in V$, is known as (1) Bessel's Inequality (2) Cauchy Schwarz inequality (3) Triangle inequality (4) None of these
95.	Given that | x : | 1 | 2 | 3 | 4 | 5 | | y : | 2 | 5 | 10 | 17 | 26 | , the value of $\nabla^2 y_3$ is (1) 3 (2) 9 (3) 5 (4) 2
96.	The order of convergence of Regula-Falsi method is (1) 2 (2) 1 . 5 (3) 1.618 (4) 2.98
97.	f (x) is given by | x : | 0 | 0.5 | 1 | 1.5 | 2.0 | | f(x) : | 1 | 0.8 | 0.5 | 0.3 | 0.1 | Then using Trapezoidal rule, the value of $\int_0^2 f(x)\,dx$ is (1) 1.075 (2) 1.575 (3) 0.775 (4) 2.150

Question No.	Questions
98.	Consider the initial value problem $\frac{dy}{dx} = -xy$; $y(0) = 1$. Then Taylor series solution upto x^4 is (1) $y = 1 + \frac{x^2}{2} + \frac{x^4}{8}$ (2) $y = x + \frac{x^2}{2} + \frac{x^4}{6}$ (3) $y = 1 + \frac{x^3}{6} + \frac{x^4}{8}$ (4) None of these
99.	The Mean and Variance are same for a distribution namely : (1) Binomial distribution (2) Poisson's distribution (3) Normal distribution (4) None of these
100.	If X follows binomial distribution with mean 3 and variance $\frac{3}{2}$, the value of $P(X \leq 5)$ is (1) $\frac{1}{64}$ (2) $\frac{1}{8}$ (3) $\frac{63}{64}$ (4) None of these

(Total No. of printed pages : 24)

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(CPG–EE–2017)

Subject : MATHEMATICS 10150

Code B

Sr. No._____

SET–"A"

Time : 1½ Hours **Total Questions : 100** **Max. Marks : 100**

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Name : _____ Date of Birth : _____

Father's Name : _____ Mother's Name :_____

Date of Examination : _____

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

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Question No.	Questions
1.	The centre of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) $(2, -3, 4)$ (2) $(-2, 3, -4)$ (3) $(-4, 6, -8)$ (4) $(4, -6, 8)$
2.	The equation of the right circular cone whose axis is $x = y = z$, vertex is the origin and the semi-vertical angle is 45° is given by (1) $(x^2 + y^2 + z^2) = 3(x + y + z)^2$ (2) $2(x + y + z)^2 = 21(x^2 + y^2 + z^2)$ (3) $3(x^2 + y^2 + z^2) = 2(x + y + z)^2$ (4) $x^2 + y^2 + z^2 = 1/2$
3.	The equation of the cylinder, whose generators are parallel to the line $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and whose guiding curve is the ellipse $x^2 + 2y^2 = 1$, $z = 0$ is given by (1) $(3z - x)^2 + 2(2z + 3y)^2 = 9$ (2) $(3x - z)^2 + 2(3y + 2z)^2 = 9$ (3) $(3x + z)^2 + 2(3y - 2z)^2 = 9$ (4) None of these
4.	The equation of the tangent to the parabola $y^2 + 4y + 20x = 0$ at $(0, 0)$ is (1) $y = 2x$ (2) $y = 5x$ (3) $x - 5y = 0$ (4) $y + 5x = 0$
5.	The equation $\frac{x^2}{a^2} - \frac{y^2}{b^2} = \frac{2z}{c}$, represents (1) Hyperboloid of one sheet (2) Elliptic Paraboloid (3) Hyperbolic Paraboloid (4) Ellipsoid
6.	$(n^7 - n)$ is divisible by (1) 1 (2) 7 (3) 30 (4) 42

Question No.	Questions
7.	Congruence $33x \equiv 22 \pmod{11}$ has (1) 3 solutions (2) 11 solutions (3) 6 solutions (4) 9 solutions
8.	If p is a prime number and 'a' denotes an integer such that (a, p) = 1, then $a^{p-1} \equiv 1 \pmod{p}$ is known as (1) Fermat's Theorem (2) Wilson's Theorem (3) Chinese Remainder Theorem (4) None of these
9.	The value of $\frac{(\cos\theta + i\sin\theta)^6}{(\cos\theta - i\sin\theta)^4}$ is (1) 1 (2) 0 (3) $\cos 10\theta + i \sin 10\theta$ (4) $\cos 2\theta + i \sin 2\theta$
10.	Which is not correct ? (1) $\sin(ix) = i \sinh x$ (2) $\operatorname{sech}\theta = \frac{2}{e^{\theta} - e^{-\theta}}$ (3) $\tanh\theta = \frac{e^{\theta} - e^{-\theta}}{e^{\theta} + e^{-\theta}}$ (4) $\cosh^2 x - \sinh^2 x = 1$
11.	With respect to standard basis vectors, a linear transformation $T : I R^4 \to IR^3$ is given by the matrix $\begin{bmatrix} 3 & -1 & -1 & 1 \\ -2 & 2 & -2 & -2 \\ -1 & 1 & 3 & -1 \end{bmatrix}$ The dimension of Ker (T) is (1) 1 (2) 2 (3) 3 (4) 4

Question No.	Questions
12.	The norm of x with respect to inner product space $< x, x >$ is given by (1) $\|\|x\\| = < x, x >$ (2) $\|\|x\\| = < x, x >^2$ (3) $\|\|x\\|^2 = < x, x >$ (4) None of these
13.	Let $T : R^n \rightarrow R^n$ be a linear transformation. Which of the following statements implies that T is bijective ? (1) Rank (T) – Nullity (T) = n (2) Rank (T) + Nullity (T) = n (3) Rank (T) = Nullity (T) = n (4) None of these
14.	Let V be an inner product space, then $\|< u, v >\| \leq \|\|u\|\|.\|\|v\|\|$ for all $u, v \in V$, is known as (1) Bessel's Inequality (2) Cauchy Schwarz inequality (3) Triangle inequality (4) None of these
15.	Given that | x : | 1 | 2 | 3 | 4 | 5 | | y : | 2 | 5 | 10 | 17 | 26 | , the value of $\nabla^2 y_3$ is (1) 3 (2) 9 (3) 5 (4) 2
16.	The order of convergence of Regula-Falsi method is (1) 2 (2) 1 . 5 (3) 1. 618 (4) 2.98
17.	f (x) is given by | x : | 0 | 0.5 | 1 | 1.5 | 2.0 | | f(x) : | 1 | 0.8 | 0.5 | 0.3 | 0.1 | Then using Trapezoidal rule, the value of $\int_0^2 f(x)\,dx$ is (1) 1.075 (2) 1.575 (3) 0.775 (4) 2.150

Question No.	Questions
18.	Consider the initial value problem $\frac{dy}{dx} = -xy$; $y(0) = 1$. Then Taylor series solution upto x^4 is (1) $y = 1 + \frac{x^2}{2} + \frac{x^4}{8}$ (2) $y = x + \frac{x^2}{2} + \frac{x^4}{6}$ (3) $y = 1 + \frac{x^3}{6} + \frac{x^4}{8}$ (4) None of these
19.	The Mean and Variance are same for a distribution namely : (1) Binomial distribution (2) Poisson's distribution (3) Normal distribution (4) None of these
20.	If X follows binomial distribution with mean 3 and variance $\frac{3}{2}$, the value of $P(X \leq 5)$ is (1) $\frac{1}{64}$ (2) $\frac{1}{8}$ (3) $\frac{63}{64}$ (4) None of these
21.	Cayley's theorem states that (1) Every finite group is isomorphic to a permutation group (2) Every finite group is isomorphic to a quotient group (3) Every subgroup of a cyclic group is cyclic (4) The order of each subgroup of a finite group is a divisor of the order of the group.

Question No.	Questions
22.	The ring of even integers is also a (1) Field (2) Integral domain (3) Division ring (4) Commutative ring
23.	A division ring has at least ..... elements. (1) 1 (2) 2 (3) 3 (4) None of these
24.	The number of trivial subgroups of a cyclic group of order 8 is (1) 0 (2) 1 (3) 2 (4) 3
25.	The transverse component of acceleration is given by (1) $\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$ (2) $\frac{d^2r}{dt^2}-r\left(\frac{d\theta}{dt}\right)^2$ (3) $\frac{d^2r}{dt^2}+r\left(\frac{d\theta}{dt}\right)^2$ (4) $r\frac{d^2\theta}{dt^2}-2\frac{dr}{dt}\frac{d\theta}{dt}$
26.	A particle executing a S.H.M. has acceleration 8 cm/sec^2 when it is at a distance 2 cm from the centre. The time period will be (1) $\frac{2}{\pi}$ sec. (2) $\frac{1}{\pi}$ sec. (3) $\frac{\pi}{2}$ sec. (4) π sec.
27.	A man while going on a scooter with a speed of 10 m/sec, a child on the road and brings the scooter to stop, 4 seconds just in time to save the child. If the weight of the scooter together with the man is 200 kg, what retarding force was applied on the scooter ? (1) 300 N (2) 400 N (3) 500 N (4) 600 N

Question No.	Questions
28.	If the greatest height attained by a projectile be equal to the horizontal range, then the angle of projection is given by (1) $\tan^{-1}\left(\frac{1}{4}\right)$ (2) $\tan^{-1} 4$ (3) $\tan^{-1} 2$ (4) $\tan^{-1}\left(\frac{1}{2}\right)$
29.	The differential equation of a central orbit under P as central force per unit mass, in polar form is given by : (Here $u = 1/r$ and h is constant). (1) $P = h^2 u^2\left[u + \frac{d^2u}{d\theta^2}\right]$ (2) $P = h^2 u^2\left[u + \left(\frac{du}{d\theta}\right)^2\right]$ (3) $P = h^2\left[u^2 + \left(\frac{du}{d\theta}\right)^2\right]$ (4) None of these
30.	Which is not correct ? (1) Relative to the sun, the planets describe ellipses with the sun as one focus. (2) The radius vector drawn from the sun to a planet sweeps out areas at a constant rate (3) The square of the periodic times are proportional to the semi-major axis of the elliptic orbits and hence also to the mean distances from the sun. (4) If a particle moves under the action of a conservative system of forces, the sum of its kinetic and potential energies remain constant throughout the motion.

Question No.	Questions
31.	The value of Bessel's function $J_{1/2}(x)$ is given by (1) $\sqrt{\frac{2}{\pi x}}\sin x$ (2) $\sqrt{\frac{2}{\pi x}}\cos x$ (3) $\sqrt{\frac{\pi x}{2}}\sin x$ (4) None of these
32.	If $P_n(x)$ is Legendre polynomial, then which of the following is not correct ? (1) $P_0(x) = 1$ (2) $P_1(x) = x$ (3) $P_n(-x) = (-1)^n P_n(x)$ (4) None of these
33.	The value of $\int_{-1}^{+1} P_n^2(x)\,dx$ is equal to (1) 0 (2) $\frac{2}{2n+1}$ (3) $\frac{2}{n+1}$ (4) 1
34.	Inverse Laplace transform of $\left[\frac{s^2-a^2}{(s^2+a^2)^2}\right]$ is (1) t sin at (2) t cosh at (3) t cos at (4) t sinh at
35.	If $F_s(s)$ and $F_c(s)$ are Fourier sine and cosine transforms of f(t), respectively, then which is correct ? (1) $F_s[f(t)\cos at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (2) $F_s[f(t)\cos at] = \frac{1}{2}[F_c(s+a) + F_c(s-a)]$ (3) $F_s[f(t)\sin at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (4) None of these

Question No.	Questions
36.	Which of the following symbols in C – Language represents logical operator ? (1) == (2) && (3) % (4) >=
37.	The purpose of strrev ( ) function in C – Language is to (1) Compare two strings (2) Find length of a string (3) Reverse the string (4) Copy one string over the other.
38.	Which of the following is an unconditional control transfer statement ? (1) if statement (2) goto statement (3) if-else statement (4) switch statement

39.	Which of the following statement is incorrect ?
	(1) while (condition) {
	statement(s) ;
	}
	(2) do {
	statement(s) ;
	} while (condition) ;
	(3) switch (expression)
	{
	case exp 1 :
	statement block-1
	break ;
	case exp 2 :
	statement block-2
	break ;
	--------- 	
	--------- 	
	default :
	default block
	}
	statement t ;
	(4) None of these

Question No.	Questions
40.	To send the value of variable using pointers is known as (1) Recursion (2) Call by reference (3) Getw function (4) None of these
41.	If $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$, then the value of $\frac{dy}{dx}$ will be (1) $\tan\frac{\theta}{2}$ (2) $\tan\theta$ (3) $\cot\frac{\theta}{2}$ (4) $\cot\theta$
42.	Let $f(x) = \sqrt{x^2 - 4}$, $x \in [2, 4]$, then which of the following is true for $f(x)$? (1) Roll's Theorem is applicable (2) Lagrange's Mean Value Theorem is applicable (3) There exists at least one $C = 2\sqrt{3}$ in (2, 4) (4) All the above are true.
43.	$\lim_{a \to b} \frac{a^b - b^a}{a^a - b^b}$ is (1) $\frac{1 - \log b}{1 + \log b}$ (2) $\frac{1 - \log b}{1 + \log a}$ (3) $\log\frac{a}{b}$ (4) None of these

Question No.	Questions
44.	If $u = \log\left(\frac{x^2+y^2}{x+y}\right)$, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ is equal to (1) 0 (2) u (3) 1 (4) e^u
45.	Which is not correct ? (where symbols have their usual meanings in differential geometry). (1) $\frac{d\vec{t}}{ds}=k\vec{n}$ (2) $\frac{d\vec{b}}{ds}=-\tau\vec{n}$ (3) $\frac{d\vec{n}}{ds}=\tau\vec{b}-k\vec{t}$ (4) $\vec{r}'.\vec{r}'''=k^2$
46.	The particular integral of $(D^2 - 2DD')\,z = \sin(x + 2y)$ is (1) $\frac{1}{6}\sin(x+2y)$ (2) $\frac{1}{3}\sin(x+2y)$ (3) $\frac{1}{6}\cos(x+2y)$ (4) None of these
47.	The partial differential equation $\frac{\partial^2 z}{\partial x^2}-4\frac{\partial^2 z}{\partial x\,\partial y}+4\frac{\partial^2 z}{\partial y^2}=0$ is (1) Parabolic (2) Hyperbolic (3) Elliptic (4) None of these

Question No.	Questions
48.	The characteristic equations of $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x\,\partial y} - 8\frac{\partial^2 u}{\partial y^2} = 0$ are given by (1) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} - 4 = 0$ (2) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} + 4 = 0$ (3) $dy + 2\,dx = 0$ and $dy - 4\,dx = 0$ (4) None of these
49.	The equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$ is called (1) One dimensional heat equation (2) Two dimensional heat equation (3) Two dimensional wave equation (4) Laplace equation
50.	Solution of $yp - xq = y^2 - x^2$ is (1) $\phi(x^2 + y^2, xy - z) = 0$ (2) $\phi(xy, x^2 + y^2 + z^2) = 0$ (3) $\phi\left(\frac{1}{x} - \frac{1}{y}, \frac{x-y}{z}\right) = 0$ (4) None of these
51.	Solution of differential equation $(y - px)^2 = 1 + p^2$, is (1) $y = cx^2 + \sqrt{1-p^2}$ (2) $y = px + \sqrt{1+p^2}$ (3) $y = px - \tan^{-1} c$ (4) $y = cx + \sqrt{1+c^2}$, is constant

Question No.	Questions
52.	P dx + x sin y dy = 0 is exact, then P can be . (1) sin y + cos y (2) – sin y (3) x^2 – cos y (4) cos y
53.	The general solution of the differential equation $(D^2 + 6D + 9)\, y = 5\, e^{2x}$ is (1) $y = (c_1 + c_2 x)\, e^{3x} + 5\, e^{2x}$ (2) $y = (c_1 + c_2 x)\, e^{-3x} + \frac{1}{5} e^{2x}$ (3) $y = (c_1 + c_2 x)\, e^{-3x} + e^{2x}$ (4) $y = (c_1 + c_2 x)\, e^{3x} + \frac{e^{2x}}{3}$
54.	The solution of the differential equation $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 0$ is (1) $y = (c_1 + c_2 \log x)\, x^2$ (2) $y = (c_1 + c_2 x)\, e^{2x}$ (3) $y = c_1 x^2 + \frac{c_2}{x}$ (4) $y = (c_1 + c_2 x)\, e^{-x}$
55.	The orthogonal trajectory of family of curves $y = ax^2$ is (1) $x^2 + y^2 = a^2$ (2) $x^2 + 2y^2 = a^2$ (3) $2x^2 + y^2 = a^2$ (4) $\frac{x^2}{a^2} - \frac{y^2}{a^2} = 1$
56.	If the vectors $2\hat{i} - \hat{j} + \hat{k}$; $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ be coplanar, then the value of a is given by (1) 1 (2) – 2 (3) – 3 (4) – 4

Question No.	Questions
57.	The value of λ so that the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector, is given by (1) 2 (2) 3 (3) -2 (4) 1
58.	Which is not correct ? (Here r, θ, z are cylindrical coordinates and $\hat{e}_r, \hat{e}_\theta, \hat{e}_z$ are unit vectors in these coordinates), (1) $\frac{d}{dt}\hat{e}_r = \dot{\theta}\,\hat{e}_\theta$ (2) $\frac{d}{dt}\hat{e}_\theta = -\dot{\theta}\,\hat{e}_r$ (3) $\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$ (4) $\hat{e}_\theta = \cos\theta\,\hat{i} - \sin\theta\,\hat{j}$
59.	If $\vec{R} = x\hat{i} + y\hat{j} + z\hat{k}$, and if S is closed surface enclosing a volume V, where $\hat{n}$ is the outward drawn unit-normal vector to the surface S, then $\iint_S \vec{R}\,.\,\hat{n}\,dS$ is equal to (1) 4V (2) 3V (3) 2V (4) V
60.	Stoke's theorem is a relation between (1) Line integral and Surface integral (2) Line integral and Volume integral (3) Surface integral and Volume integral (4) None of these

Question No.	Questions
61.	The resultant of two forces P and Q act at right angles to P, the angle between the forces is (1) $\cos^{-1}\left(-\frac{P}{Q}\right)$ (2) $\tan^{-1}\left(-\frac{P}{Q}\right)$ (3) $\sin^{-1}\left(-\frac{Q}{P}\right)$ (4) $\cos^{-1}\left(\frac{P}{Q}\right)$
62.	Three forces 2P, 3P and 4P act at a point in direction parallel to the sides of an equilateral triangle taken in order. Magnitude of the resultant is (1) 3P (2) 2P (3) $\sqrt{17}$ P (4) $\sqrt{3}$ P
63.	If the normal reaction is 10 units and limiting friction is 5 units, then the coefficient of friction is (1) 2 (2) $\frac{2}{3}$ (3) $\frac{1}{2}$ (4) None of these
64.	Suppose a system of forces is reduced to a single force $\vec{R}$ and a Couple of moment $\vec{k}$ whose axis coincides with the direction of acting force, then $\vec{R}$ and $\vec{k}$ taken together are called (1) Null line (2) Wrench (3) Pitch (4) None of these

Question No.	Questions
65.	The condition that the straight line $\frac{x-f}{\ell}=\frac{y-g}{m}=\frac{z-h}{n}$ may be a null line for the system of forces (X, Y, Z ; L, M, N) is (1) $\begin{vmatrix} X & Y & Z \\ \ell & m & n \\ f & g & h \end{vmatrix} = L\ell + Mm + Nn$ (2) $\begin{vmatrix} x & y & z \\ \ell & m & n \\ X & Y & Z \end{vmatrix} = -(L\ell + Mm + Nn)$ (3) $Lx + My + Nz = 0$ (4) None of these
66.	The greatest lower bound of $\left\{\left(1+\frac{1}{n}\right)^n\right\}$ is (1) 0 (2) 2 (3) 1 (4) None of these
67.	The sequence $\left\{\frac{2n-7}{3n+2}\right\}$ is (1) Monotonic increasing, and is bounded. (2) Monotonic decreasing, and is bounded. (3) Monotonic increasing and is not bounded. (4) Monotonic decreasing and is not bounded.

Question No.	Questions
68.	The series whose n^{th} term is $\left(\sqrt{n^3+1}-\sqrt{n^3}\right)$ is (1) Divergent (2) Convergent (3) Oscillatory (4) None of these
69.	If $\sum u_n$ is a series of positive terms and if $\lim_{n\to\infty}(u_n)^{1/n}=\ell$, then the series is divergent if (1) $\ell > 1$ (2) $\ell < 1$ (3) $\ell \leq 1$ (4) None of these
70.	"A series obtained from an absolutely convergent series by a rearrangement of terms converges absolutely and has the same sum as the original series", is statement of a theorem known as (1) Riemann's rearrangement theorem (2) Dirichlet's theorem (3) Pringsheim's theorem (4) Cauchy's theorem
71.	If a function f be bounded on [a, b], then (1) f is necessarily R-integrable (2) f is R-integrable if $[a, b] \subset N$ (3) f is not necessarily R-integrable (4) f is R-integrable if $[a, b] = N \cup \phi$
72.	If f be a monotonic function, then (1) f be R-integrable (2) f be R-integrable if $f \neq 0$ (3) f be bounded (4) All the above

Question No.	Questions
73.	If f is integrable on [a, b] and F is the primitive of f on [a, b], then $\int_a^b f\,dx = F(b) - F(a)$ is statement of (1) First Mean Value theorem (2) Fundamental theorem of integral calculus (3) Baire's Category theorem (4) None of these
74.	The integral $\int_0^{\pi/2} \frac{\sin x}{x^n}\,dx$ converges if (1) $n < 1$ (2) $n > 1$ (3) $n > 2$ (4) $n < 2$
75.	If on a non-empty set X, $d : X \times X \to R$ be a function such that $d(x, y) = \begin{cases} 0 \text{ if } x = y \\ 1 \text{ if } x \neq y \end{cases}$, then (1) (X, d) is a semi-metric space (2) (X, d) is a metric-space (3) (X, d) is not a metric-space (4) None of these
76.	The derived set for the set $S = \left\{\frac{1}{n}; n \in N\right\}$ is (1) R (2) N (3) {0} (4) {0, ∞}

Question No.	Questions
77.	The statement "Every complete metric space is of the second category as a subset of itself" refers to (1) Baire's Category Theorem (2) Cantor's intersection Theorem (3) Bolzano-Weierstrass property (4) None of these
78.	The set $G = \{1, w, w^2\}$, where w is a cube root of unity, with respect to multiplication is a (1) Group (2) Abelian group (3) Cyclic group (4) All of these
79.	If H and K are two non-empty subsets of abelian group G, then HK is a subgroup of G if (1) H is a subgroup of G (2) K is a subgroup of G (3) $H \cap K$ is subgroup of G (4) H as well as K are subgroups of G.
80.	If p is a prime, then any group G of order 2p has (1) a normal subgroup of order p (2) a normal subgroup of order 2p (3) a normal subgroup of order p^2 (4) None of these

Question No.	Questions
81.	If matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$, then A^2 is equal to (1) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} -1 & -2 & -3 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$
82.	If $A = \begin{bmatrix} 0 & 4 & -2 \\ x & 0 & -y \\ 2 & -8 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then $x - y =$ ..... is (1) 8 (2) 4 (3) -12 (4) -8
83.	If $3x + 2y + z = 0$; $x + 4y + z = 0$; $2x + y + 4z = 0$, be a system of equations, then (1) It is inconsistent (2) It can be reduced to a single equation and so a solution does not exist. (3) It has only the trivial solution $x = 0, y = 0, z = 0$ (4) The determinant of the matrix of coefficient is zero.

Question No.	Questions
84.	The condition that the cubic equation $x^3 - px^2 + qx - r = 0$ has all of its three roots equal is given by (1) $p^2 = 3qr$ (2) $q^2 = 3pr$ (3) $r^2 = 3pq$ (4) None of these
85.	Which of the following is not correct ? (1) Every square matrix satisfies its own characteristic equation. (2) If λ is an eigen-value of a matrix A, then $\frac{1}{\lambda}$ is the eigen-value of the matrix A^{-1}. (3) The sum of the eigen-values of a matrix is equal to the sum of elements of principal diagonal. (4) The matrices A and A^T have different eigen-values.
86.	Which of the following function f (x) is differentiable at the origin : (1) $f(x) = \lvert x \rvert$ (2) $f(x) = x^{2/3}$ (3) $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ (4) $f(x) = e^{-1/x^2}$
87.	The curve $2x^2 - 3xy - 2y^2 = 1$ has two asymptotes that are (1) Perpendicular (2) Parallel (3) Intersect at an angle 60° (4) None of these

Question No.	Questions
88.	The radius of curvature of the curve $y = e^x$ at the point where it crosses the y-axis is (1) 2 (2) $\frac{\sqrt{2}}{2}$ (3) $2\sqrt{2}$ (4) $\sqrt{2}$
89.	For the curve $y^2(1+x) = x^2(1-x)$, the origin is a (1) Cusp (2) Point of inflexion (3) Node (4) None of these
90.	The area of surface of the solid generated by the revolution of the line segment $y = 2x$ from $x = 0$ to $x = 2$, about x-axis is equal to (1) $\pi\sqrt{5}$ (2) $2\pi\sqrt{5}$ (3) $4\pi\sqrt{5}$ (4) $8\pi\sqrt{5}$
91.	If $u = x + y$, and $v = (x+y)^2$, then value of $\frac{\partial(u,v)}{\partial(x,y)}$ is (1) 0 (2) $4(x+y)^2$ (3) x (4) $\frac{1}{x}$
92.	The value of Beta function $\beta\left(\frac{1}{2},\frac{1}{2}\right)$ is (1) $\sqrt{2\pi}$ (2) $\pi\sqrt{2}$ (3) $\sqrt{\pi}$ (4) π

Question No.	Questions
93.	The area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is given by (1) πab (2) $2\pi ab$ (3) $\pi a^2 b$ (4) πab^2
94.	The Fourier series for the function $f(x) = \lvert x \rvert, -\pi \le x \le \pi$ contains (1) only sine terms (2) only cosine terms (3) both sine and cosine terms (4) None of these
95.	The Harmonic conjugate of $u(x, y) = \frac{y}{x^2+y^2}$ is (1) $\frac{x}{x^2+y^2}$ (2) $\frac{-x}{x^2+y^2}$ (3) $\frac{1}{x^2+y^2}$ (4) x^2-y^2
96.	The fixed points of the mapping $w = \frac{(5Z+4)}{(Z+5)}$ are (1) 2, 2 (2) –2, –2 (3) 2, –2 (4) None of these
97.	The bilinear transformation that maps the points $z = \infty$, i, 0 into the points $w = 0$, i and ∞ is given by (1) $w = z$ (2) $w = -z$ (3) $w = \frac{1}{z}$ (4) $w = -\frac{1}{z}$

Question No.	Questions
98.	For a non-empty subset W of a vector space V(F), which of the following is incorrect ? (1) W be subspace if $u - v \in W$, $a\,u \in W$ for $u, v \in W$, $a \in F$ (2) W be subspace iff $au + bv \in W$ for $u, v \in W$; $a, b \in F$ (3) The union of any two subspaces of V(F) is a subspace (4) None of these
99.	Which of the following set form the basis of R^3 : (1) {(2, 3, 1), (7, – 6, 17), (5, 2, 7)} (2) {(2, 1, 4), (1, –1, 2), (3, 1, –2)} (3) {(1, –1, 3), (1, 2, –3), (1, 0, 1)} (4) None of these
100.	Which of the following functions T from $V_2(R)$ into $V_2(R)$ is not a linear transformation ? (1) $T(x, y) = (y, x)$ (2) $T(x, y) = (x + y, x)$ (3) $T(x, y) = (x - y, y - x)$ (4) $T(x, y) = (1 + x, y)$

(Total No. of printed pages : 24)

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(CPG–EE–2017)

Subject : MATHEMATICS

Sr. No. 10119

Code C

SET–"A"

Time : 1½ Hours **Total Questions : 100** **Max. Marks : 100**

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

Name : _____ Date of Birth : _____

Father's Name : _____ Mother's Name : _____

Date of Examination : _____

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

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Question No.	Questions
1.	The resultant of two forces P and Q act at right angles to P, the angle between the forces is (1) $\cos^{-1}\left(-\frac{P}{Q}\right)$ (2) $\tan^{-1}\left(-\frac{P}{Q}\right)$ (3) $\sin^{-1}\left(-\frac{Q}{P}\right)$ (4) $\cos^{-1}\left(\frac{P}{Q}\right)$
2.	Three forces 2P, 3P and 4P act at a point in direction parallel to the sides of an equilateral triangle taken in order. Magnitude of the resultant is (1) 3P (2) 2P (3) $\sqrt{17}$ P (4) $\sqrt{3}$ P
3.	If the normal reaction is 10 units and limiting friction is 5 units, then the coefficient of friction is (1) 2 (2) $\frac{2}{3}$ (3) $\frac{1}{2}$ (4) None of these
4.	Suppose a system of forces is reduced to a single force $\vec{R}$ and a Couple of moment $\vec{k}$ whose axis coincides with the direction of acting force, then $\vec{R}$ and $\vec{k}$ taken together are called (1) Null line (2) Wrench (3) Pitch (4) None of these

Question No.	Questions
5.	The condition that the straight line $\frac{x-f}{\ell}=\frac{y-g}{m}=\frac{z-h}{n}$ may be a null line for the system of forces (X, Y, Z ; L, M, N) is (1) $\begin{vmatrix} X & Y & Z \\ \ell & m & n \\ f & g & h \end{vmatrix} = L\ell + Mm + Nn$ (2) $\begin{vmatrix} x & y & z \\ \ell & m & n \\ X & Y & Z \end{vmatrix} = -(L\ell + Mm + Nn)$ (3) $Lx + My + Nz = 0$ (4) None of these
6.	The greatest lower bound of $\left\{\left(1+\frac{1}{n}\right)^n\right\}$ is (1) 0 (2) 2 (3) 1 (4) None of these
7.	The sequence $\left\{\frac{2n-7}{3n+2}\right\}$ is (1) Monotonic increasing, and is bounded. (2) Monotonic decreasing, and is bounded. (3) Monotonic increasing and is not bounded. (4) Monotonic decreasing and is not bounded.

Question No.	Questions
8.	The series whose n^{th} term is $\left(\sqrt{n^3+1}-\sqrt{n^3}\right)$ is (1) Divergent (2) Convergent (3) Oscillatory (4) None of these
9.	If $\sum u_n$ is a series of positive terms and if $\lim_{n\to\infty}(u_n)^{1/n}=\ell$, then the series is divergent if (1) $\ell > 1$ (2) $\ell < 1$ (3) $\ell \leq 1$ (4) None of these
10.	"A series obtained from an absolutely convergent series by a rearrangement of terms converges absolutely and has the same sum as the original series", is statement of a theorem known as (1) Riemann's rearrangement theorem (2) Dirichlet's theorem (3) Pringsheim's theorem (4) Cauchy's theorem
11.	Solution of differential equation $(y - px)^2 = 1 + p^2$, is (1) $y = cx^2 + \sqrt{1-p^2}$ (2) $y = px + \sqrt{1+p^2}$ (3) $y = px - \tan^{-1} c$ (4) $y = cx + \sqrt{1+c^2}$, is constant
12.	$P\,dx + x \sin y\,dy = 0$ is exact, then P can be (1) $\sin y + \cos y$ (2) $-\sin y$ (3) $x^2 - \cos y$ (4) $\cos y$
13.	The general solution of the differential equation $(D^2 + 6D + 9)\,y = 5\,e^{2x}$ is (1) $y = (c_1 + c_2 x)\,e^{3x} + 5\,e^{2x}$ (2) $y = (c_1 + c_2 x)\,e^{-3x} + \frac{1}{5}\,e^{2x}$ (3) $y = (c_1 + c_2 x)\,e^{-3x} + e^{2x}$ (4) $y = (c_1 + c_2 x)\,e^{3x} + \frac{e^{2x}}{3}$

Question No.	Questions
14.	The solution of the differential equation $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 0$ is (1) $y = (c_1 + c_2 \log x)\, x^2$ (2) $y = (c_1 + c_2 x)\, e^{2x}$ (3) $y = c_1 x^2 + \frac{c_2}{x}$ (4) $y = (c_1 + c_2 x)\, e^{-x}$
15.	The orthogonal trajectory of family of curves $y = ax^2$ is (1) $x^2 + y^2 = a^2$ (2) $x^2 + 2y^2 = a^2$ (3) $2x^2 + y^2 = a^2$ (4) $\frac{x^2}{a^2} - \frac{y^2}{a^2} = 1$
16.	If the vectors $2\hat{i} - \hat{j} + \hat{k}$; $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ be coplanar, then the value of a is given by (1) 1 (2) -2 (3) -3 (4) -4
17.	The value of λ so that the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector, is given by (1) 2 (2) 3 (3) -2 (4) 1
18.	Which is not correct ? (Here r, θ, z are cylindrical coordinates and $\hat{e}_r, \hat{e}_\theta, \hat{e}_z$ are unit vectors in these coordinates), (1) $\frac{d}{dt}\hat{e}_r = \dot{\theta}\,\hat{e}_\theta$ (2) $\frac{d}{dt}\hat{e}_\theta = -\dot{\theta}\,\hat{e}_r$ (3) $\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$ (4) $\hat{e}_\theta = \cos\theta\,\hat{i} - \sin\theta\,\hat{j}$

Question No.	Questions
19.	If $\vec{R} = x\hat{i} + y\hat{j} + z\hat{k}$, and if S is closed surface enclosing a volume V, where $\hat{n}$ is the outward drawn unit-normal vector to the surface S, then $\iint_S \vec{R} \cdot \hat{n}\, dS$ is equal to (1) 4V (2) 3V (3) 2V (4) V
20.	Stoke's theorem is a relation between (1) Line integral and Surface integral (2) Line integral and Volume integral (3) Surface integral and Volume integral (4) None of these
21.	If matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$, then A^2 is equal to (1) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} -1 & -2 & -3 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

Question No.	Questions
22.	If $A = \begin{bmatrix} 0 & 4 & -2 \\ x & 0 & -y \\ 2 & -8 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then $x - y =$ ..... is (1) 8 (2) 4 (3) -12 (4) -8
23.	If $3x + 2y + z = 0$; $x + 4y + z = 0$; $2x + y + 4z = 0$, be a system of equations, then (1) It is inconsistent (2) It can be reduced to a single equation and so a solution does not exist. (3) It has only the trivial solution $x = 0, y = 0, z = 0$ (4) The determinant of the matrix of coefficient is zero.
24.	The condition that the cubic equation $x^3 - px^2 + qx - r = 0$ has all of its three roots equal is given by (1) $p^2 = 3qr$ (2) $q^2 = 3pr$ (3) $r^2 = 3pq$ (4) None of these
25.	Which of the following is not correct ? (1) Every square matrix satisfies its own characteristic equation. (2) If λ is an eigen-value of a matrix A, then $\frac{1}{\lambda}$ is the eigen-value of the matrix A^{-1}. (3) The sum of the eigen-values of a matrix is equal to the sum of elements of principal diagonal. (4) The matrices A and A^T have different eigen-values.

Question No.	Questions
26.	Which of the following function f (x) is differentiable at the origin : (1) $f(x) = \|x\|$ (2) $f(x) = x^{2/3}$ (3) $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ (4) $f(x) = e^{-1/x^2}$
27.	The curve $2x^2 - 3xy - 2y^2 = 1$ has two asymptotes that are (1) Perpendicular (2) Parallel (3) Intersect at an angle 60° (4) None of these
28.	The radius of curvature of the curve $y = e^x$ at the point where it crosses the y-axis is (1) 2 (2) $\frac{\sqrt{2}}{2}$ (3) $2\sqrt{2}$ (4) $\sqrt{2}$
29.	For the curve $y^2 (1 + x) = x^2 (1 - x)$, the origin is a (1) Cusp (2) Point of inflexion (3) Node (4) None of these
30.	The area of surface of the solid generated by the revolution of the line segment $y = 2x$ from $x = 0$ to $x = 2$, about x-axis is equal to (1) $\pi\sqrt{5}$ (2) $2\pi\sqrt{5}$ (3) $4\pi\sqrt{5}$ (4) $8\pi\sqrt{5}$

Question No.	Questions
31.	With respect to standard basis vectors, a linear transformation $T : I R^4 \rightarrow IR^3$ is given by the matrix $\begin{bmatrix} 3 & -1 & -1 & 1 \\ -2 & 2 & -2 & -2 \\ -1 & 1 & 3 & -1 \end{bmatrix}$ The dimension of Ker (T) is (1) 1 (2) 2 (3) 3 (4) 4
32.	The norm of x with respect to inner product space $< x, x >$ is given by (1) $\|\|x\|\| = < x, x >$ (2) $\|\|x\|\| = < x, x >^2$ (3) $\|\|x\|\|^2 = < x, x >$ (4) None of these
33.	Let $T : R^n \rightarrow R^n$ be a linear transformation. Which of the following statements implies that T is bijective ? (1) Rank (T) – Nullity (T) = n (2) Rank (T) + Nullity (T) = n (3) Rank (T) = Nullity (T) = n (4) None of these
34.	Let V be an inner product space, then $\|< u, v >\| \leq \|\|u\|\| . \|\|v\|\|$ for all $u, v \in V$, is known as (1) Bessel's Inequality (2) Cauchy Schwarz inequality (3) Triangle inequality (4) None of these
35.	Given that | x : | 1 | 2 | 3 | 4 | 5 | | y : | 2 | 5 | 10 | 17 | 26 | , the value of $\nabla^2 y_3$ is (1) 3 (2) 9 (3) 5 (4) 2

Question No.	Questions
36.	The order of convergence of Regula-Falsi method is (1) 2 (2) 1 . 5 (3) 1. 618 (4) 2.98
37.	f (x) is given by | x :	0	0.5	1	1.5	2.0
f (x) :	1	0.8	0.5	0.3	0.1	 Then using Trapezoidal rule, the value of $\int_0^2 f(x)\,dx$ is (1) 1.075 (2) 1.575 (3) 0.775 (4) 2.150
38.	Consider the initial value problem $\frac{dy}{dx} = -xy$; y (0) = 1. Then Taylor series solution upto x^4 is (1) $y = 1 + \frac{x^2}{2} + \frac{x^4}{8}$ (2) $y = x + \frac{x^2}{2} + \frac{x^4}{6}$ (3) $y = 1 + \frac{x^3}{6} + \frac{x^4}{8}$ (4) None of these
39.	The Mean and Variance are same for a distribution namely : (1) Binomial distribution (2) Poisson's distribution (3) Normal distribution (4) None of these

Question No.	Questions
40.	If X follows binomial distribution with mean 3 and variance $\frac{3}{2}$, the value of P (X ≤ 5) is (1) $\frac{1}{64}$ (2) $\frac{1}{8}$ (3) $\frac{63}{64}$ (4) None of these
41.	If a function f be bounded on [a, b], then (1) f is necessarily R-integrable (2) f is R-integrable if [a, b] ⊂ N (3) f is not necessarily R-integrable (4) f is R-integrable if [a, b] = N ∪ ϕ
42.	If f be a monotonic function, then (1) f be R-integrable (2) f be R-integrable if f ≠ 0 (3) f be bounded (4) All the above
43.	If f is integrable on [a, b] and F is the primitive of f on [a, b], then $\int_a^b f\,dx = F(b) - F(a)$ is statement of (1) First Mean Value theorem (2) Fundamental theorem of integral calculus (3) Baire's Category theorem (4) None of these

Question No.	Questions
44.	The integral $\int_0^{\pi/2} \frac{\sin x}{x^n} dx$ converges if (1) $n < 1$ (2) $n > 1$ (3) $n > 2$ (4) $n < 2$
45.	If on a non-empty set X, $d : X \times X \to R$ be a function such that $d(x, y) = \begin{cases} 0 \text{ if } x = y \\ 1 \text{ if } x \neq y \end{cases}$, then (1) (X, d) is a semi-metric space (2) (X, d) is a metric-space (3) (X, d) is not a metric-space (4) None of these
46.	The derived set for the set $S = \left\{\frac{1}{n}; n \in N\right\}$ is (1) R (2) N (3) {0} (4) {0, ∞}
47.	The statement "Every complete metric space is of the second category as a subset of itself" refers to (1) Baire's Category Theorem (2) Cantor's intersection Theorem (3) Bolzano-Weierstrass property (4) None of these
48.	The set $G = \{1, w, w^2\}$, where w is a cube root of unity, with respect to multiplication is a (1) Group (2) Abelian group (3) Cyclic group (4) All of these

Question No.	Questions
49.	If H and K are two non-empty subsets of abelian group G, then HK is a subgroup of G if (1) H is a subgroup of G (2) K is a subgroup of G (3) $H \cap K$ is subgroup of G (4) H as well as K are subgroups of G.
50.	If p is a prime, then any group G of order 2p has (1) a normal subgroup of order p (2) a normal subgroup of order 2p (3) a normal subgroup of order p^2 (4) None of these
51.	If $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$, then the value of $\frac{dy}{dx}$ will be (1) $\tan\frac{\theta}{2}$ (2) $\tan\theta$ (3) $\cot\frac{\theta}{2}$ (4) $\cot\theta$
52.	Let $f(x) = \sqrt{x^2 - 4}$, $x \in [2, 4]$, then which of the following is true for f (x) ? (1) Roll's Theorem is applicable (2) Lagrange's Mean Value Theorem is applicable (3) There exists at least one $C = 2\sqrt{3}$ in (2, 4) (4) All the above are true.

Question No.	Questions
53.	$\lim_{a \to b} \frac{a^b - b^a}{a^a - b^b}$ is (1) $\frac{1-\log b}{1+\log b}$ (2) $\frac{1-\log b}{1+\log a}$ (3) $\log \frac{a}{b}$ (4) None of these
54.	If $u = \log\left(\frac{x^2+y^2}{x+y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to (1) 0 (2) u (3) 1 (4) e^u
55.	Which is not correct ? (where symbols have their usual meanings in differential geometry). (1) $\frac{d\vec{t}}{ds} = k\vec{n}$ (2) $\frac{d\vec{b}}{ds} = -\tau\vec{n}$ (3) $\frac{d\vec{n}}{ds} = \tau\vec{b} - k\vec{t}$ (4) $\vec{r}'.\vec{r}''' = k^2$
56.	The particular integral of $(D^2 - 2DD')z = \sin(x + 2y)$ is (1) $\frac{1}{6}\sin(x+2y)$ (2) $\frac{1}{3}\sin(x+2y)$ (3) $\frac{1}{6}\cos(x+2y)$ (4) None of these

Question No.	Questions
57.	The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x\,\partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is (1) Parabolic (2) Hyperbolic (3) Elliptic (4) None of these
58.	The characteristic equations of $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x\,\partial y} - 8\frac{\partial^2 u}{\partial y^2} = 0$ are given by (1) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} - 4 = 0$ (2) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} + 4 = 0$ (3) $dy + 2\,dx = 0$ and $dy - 4\,dx = 0$ (4) None of these
59.	The equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$ is called (1) One dimensional heat equation (2) Two dimensional heat equation (3) Two dimensional wave equation (4) Laplace equation
60.	Solution of $yp - xq = y^2 - x^2$ is (1) $\phi(x^2 + y^2, xy - z) = 0$ (2) $\phi(xy, x^2 + y^2 + z^2) = 0$ (3) $\phi\left(\frac{1}{x} - \frac{1}{y}, \frac{x-y}{z}\right) = 0$ (4) None of these

Question No.	Questions
61.	Cayley's theorem states that (1) Every finite group is isomorphic to a permutation group (2) Every finite group is isomorphic to a quotient group (3) Every subgroup of a cyclic group is cyclic (4) The order of each subgroup of a finite group is a divisor of the order of the group.
62.	The ring of even integers is also a (1) Field (2) Integral domain (3) Division ring (4) Commutative ring
63.	A division ring has at least ..... elements. (1) 1 (2) 2 (3) 3 (4) None of these
64.	The number of trivial subgroups of a cyclic group of order 8 is (1) 0 (2) 1 (3) 2 (4) 3
65.	The transverse component of acceleration is given by (1) $\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$ (2) $\frac{d^2r}{dt^2}-r\left(\frac{d\theta}{dt}\right)^2$ (3) $\frac{d^2r}{dt^2}+r\left(\frac{d\theta}{dt}\right)^2$ (4) $r\frac{d^2\theta}{dt^2}-2\frac{dr}{dt}\frac{d\theta}{dt}$

Question No.	Questions
66.	A particle executing a S.H.M. has acceleration 8 cm/sec^2 when it is at a distance 2 cm from the centre. The time period will be (1) $\frac{2}{\pi}$ sec. (2) $\frac{1}{\pi}$ sec. (3) $\frac{\pi}{2}$ sec. (4) π sec.
67.	A man while going on a scooter with a speed of 10 m/sec, a child on the road and brings the scooter to stop, 4 seconds just in time to save the child. If the weight of the scooter together with the man is 200 kg, what retarding force was applied on the scooter ? (1) 300 N (2) 400 N (3) 500 N (4) 600 N
68.	If the greatest height attained by a projectile be equal to the horizontal range, then the angle of projection is given by (1) $\tan^{-1}\left(\frac{1}{4}\right)$ (2) $\tan^{-1} 4$ (3) $\tan^{-1} 2$ (4) $\tan^{-1}\left(\frac{1}{2}\right)$
69.	The differential equation of a central orbit under P as central force per unit mass, in polar form is given by : (Here $u = 1/r$ and h is constant). (1) $P = h^2 u^2\left[u + \frac{d^2u}{d\theta^2}\right]$ (2) $P = h^2 u^2\left[u + \left(\frac{du}{d\theta}\right)^2\right]$ (3) $P = h^2\left[u^2 + \left(\frac{du}{d\theta}\right)^2\right]$ (4) None of these

Question No.	Questions
70.	Which is not correct ? (1) Relative to the sun, the planets describe ellipses with the sun as one focus. (2) The radius vector drawn from the sun to a planet sweeps out areas at a constant rate (3) The square of the periodic times are proportional to the semi-major axis of the elliptic orbits and hence also to the mean distances from the sun. (4) If a particle moves under the action of a conservative system of forces, the sum of its kinetic and potential energies remain constant throughout the motion.
71.	If $u = x + y$, and $v = (x + y)^2$, then value of $\frac{\partial (u, v)}{\partial (x, y)}$ is (1) 0 (2) $4 (x + y)^2$ (3) x (4) $\frac{1}{x}$
72.	The value of Beta function $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$ is (1) $\sqrt{2\pi}$ (2) $\pi\sqrt{2}$ (3) $\sqrt{\pi}$ (4) π
73.	The area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is given by (1) πab (2) $2\pi ab$ (3) $\pi a^2 b$ (4) πab^2
74.	The Fourier series for the function $f(x) = \lvert x \rvert, -\pi \leq x \leq \pi$ contains (1) only sine terms (2) only cosine terms (3) both sine and cosine terms (4) None of these

Question No.	Questions
75.	The Harmonic conjugate of $u(x, y) = \frac{y}{x^2+y^2}$ is (1) $\frac{x}{x^2+y^2}$ (2) $\frac{-x}{x^2+y^2}$ (3) $\frac{1}{x^2+y^2}$ (4) $x^2 - y^2$
76.	The fixed points of the mapping $w = \frac{(5Z+4)}{(Z+5)}$ are (1) 2, 2 (2) –2, –2 (3) 2, –2 (4) None of these
77.	The bilinear transformation that maps the points $z = \infty$, i, 0 into the points $w = 0$, i and ∞ is given by (1) $w = z$ (2) $w = -z$ (3) $w = \frac{1}{z}$ (4) $w = -\frac{1}{z}$
78.	For a non-empty subset W of a vector space V(F), which of the following is incorrect ? (1) W be subspace if $u - v \in W$, $a\,u \in W$ for $u, v \in W$, $a \in F$ (2) W be subspace iff $au + bv \in W$ for $u, v \in W$; $a, b \in F$ (3) The union of any two subspaces of V(F) is a subspace (4) None of these
79.	Which of the following set form the basis of R^3 : (1) {(2, 3, 1), (7, – 6, 17), (5, 2, 7)} (2) {(2, 1, 4), (1, –1, 2), (3, 1, –2)} (3) {(1, –1, 3), (1, 2, –3), (1, 0, 1)} (4) None of these

Question No.	Questions
80.	Which of the following functions T from $V_2(R)$ into $V_2(R)$ is not a linear transformation ? (1) $T(x, y) = (y, x)$ (2) $T(x, y) = (x + y, x)$ (3) $T(x, y) = (x - y, y - x)$ (4) $T(x, y) = (1 + x, y)$
81.	The centre of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) $(2, -3, 4)$ (2) $(-2, 3, -4)$ (3) $(-4, 6, -8)$ (4) $(4, -6, 8)$
82.	The equation of the right circular cone whose axis is $x = y = z$, vertex is the origin and the semi-vertical angle is $45°$ is given by (1) $(x^2 + y^2 + z^2) = 3(x + y + z)^2$ (2) $2(x + y + z)^2 = 21(x^2 + y^2 + z^2)$ (3) $3(x^2 + y^2 + z^2) = 2(x + y + z)^2$ (4) $x^2 + y^2 + z^2 = 1/2$
83.	The equation of the cylinder, whose generators are parallel to the line $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and whose guiding curve is the ellipse $x^2 + 2y^2 = 1$, $z = 0$ is given by (1) $(3z - x)^2 + 2(2z + 3y)^2 = 9$ (2) $(3x - z)^2 + 2(3y + 2z)^2 = 9$ (3) $(3x + z)^2 + 2(3y - 2z)^2 = 9$ (4) None of these
84.	The equation of the tangent to the parabola $y^2 + 4y + 20x = 0$ at $(0, 0)$ is (1) $y = 2x$ (2) $y = 5x$ (3) $x - 5y = 0$ (4) $y + 5x = 0$

Question No.	Questions
85.	The equation $\frac{x^2}{a^2}-\frac{y^2}{b^2}=\frac{2z}{c}$, represents (1) Hyperboloid of one sheet (2) Elliptic Paraboloid (3) Hyperbolic Paraboloid (4) Ellipsoid
86.	$(n^7 - n)$ is divisible by (1) 1 (2) 7 (3) 30 (4) 42
87.	Congruence $33x \equiv 22 \pmod{11}$ has (1) 3 solutions (2) 11 solutions (3) 6 solutions (4) 9 solutions
88.	If p is a prime number and 'a' denotes an integer such that (a, p) = 1, then $a^{p-1} \equiv 1 \pmod{p}$ is known as (1) Fermat's Theorem (2) Wilson's Theorem (3) Chinese Remainder Theorem (4) None of these
89.	The value of $\frac{(\cos\theta+i\sin\theta)^6}{(\cos\theta-i\sin\theta)^4}$ is (1) 1 (2) 0 (3) $\cos 10\theta + i \sin 10\theta$ (4) $\cos 2\theta + i \sin 2\theta$
90.	Which is not correct ? (1) $\sin(ix) = i \sinh x$ (2) $\operatorname{sech}\theta = \frac{2}{e^{\theta}-e^{-\theta}}$ (3) $\tanh\theta = \frac{e^{\theta}-e^{-\theta}}{e^{\theta}+e^{-\theta}}$ (4) $\cosh^2 x - \sinh^2 x = 1$

Question No.	Questions
91.	The value of Bessel's function $J_{1/2}(x)$ is given by (1) $\sqrt{\frac{2}{\pi x}}\sin x$ (2) $\sqrt{\frac{2}{\pi x}}\cos x$ (3) $\sqrt{\frac{\pi x}{2}}\sin x$ (4) None of these
92.	If $P_n(x)$ is Legendre polynomial, then which of the following is not correct ? (1) $P_0(x) = 1$ (2) $P_1(x) = x$ (3) $P_n(-x) = (-1)^n P_n(x)$ (4) None of these
93.	The value of $\int_{-1}^{+1} P_n^2(x)\,dx$ is equal to (1) 0 (2) $\frac{2}{2n+1}$ (3) $\frac{2}{n+1}$ (4) 1
94.	Inverse Laplace transform of $\left[\frac{s^2-a^2}{(s^2+a^2)^2}\right]$ is (1) t sin at (2) t cosh at (3) t cos at (4) t sinh at

Question No.	Questions
95.	If $F_s(s)$ and $F_c(s)$ are Fourier sine and cosine transforms of f(t), respectively, then which is correct ? (1) $F_s[f(t)\cos at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (2) $F_s[f(t)\cos at] = \frac{1}{2}[F_c(s+a) + F_c(s-a)]$ (3) $F_s[f(t)\sin at] = \frac{1}{2}[F_s(s+a) + F_s(s-a)]$ (4) None of these
96.	Which of the following symbols in C – Language represents logical operator ? (1) == (2) && (3) % (4) >=
97.	The purpose of strrev ( ) function in C – Language is to (1) Compare two strings (2) Find length of a string (3) Reverse the string (4) Copy one string over the other.
98.	Which of the following is an unconditional control transfer statement ? (1) if statement (2) goto statement (3) if-else statement (4) switch statement

Question No.	Questions

99.	Which of the following statement is incorrect ?
	(1) while (condition) {
	statement(s) ;
	}
	(2) do {
	statement(s) ;
	} while (condition) ;
	(3) switch (expression)
	{
	case exp 1 :
	statement block-1
	break ;
	case exp 2 :
	statement block-2
	break ;
	---------- 	
	---------- 	
	default :
	default block
	}
	statement t ;
	(4) None of these

100.	To send the value of variable using pointers is known as (1) Recursion (2) Call by reference (3) Getw function (4) None of these

(Total No. of printed pages : 24)

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(CPG–EE–2017)

Subject : MATHEMATICS

Sr. No. 10120

Code D

SET–"A"

Time : 1½ Hours **Total Questions : 100** **Max. Marks : 100**

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

Name : _____ Date of Birth : _____

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 and carry equal marks. The candidates are required to attempt all questions.
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. **Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.**
6. **There will be <u>Negative</u> marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

observed at 4.18 pm 24/6/17 24/6/17

Question No.	Questions
1.	Cayley's theorem states that (1) Every finite group is isomorphic to a permutation group (2) Every finite group is isomorphic to a quotient group (3) Every subgroup of a cyclic group is cyclic (4) The order of each subgroup of a finite group is a divisor of the order of the group.
2.	The ring of even integers is also a (1) Field (2) Integral domain (3) Division ring (4) Commutative ring
3.	A division ring has at least ..... elements. (1) 1 (2) 2 (3) 3 (4) None of these
4.	The number of trivial subgroups of a cyclic group of order 8 is (1) 0 (2) 1 (3) 2 (4) 3
5.	The transverse component of acceleration is given by (1) $\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$ (2) $\frac{d^2r}{dt^2}-r\left(\frac{d\theta}{dt}\right)^2$ (3) $\frac{d^2r}{dt^2}+r\left(\frac{d\theta}{dt}\right)^2$ (4) $r\frac{d^2\theta}{dt^2}-2\frac{dr}{dt}\frac{d\theta}{dt}$

Question No.	Questions
6.	A particle executing a S.H.M. has acceleration 8 cm/sec^2 when it is at a distance 2 cm from the centre. The time period will be (1) $\frac{2}{\pi}$ sec. (2) $\frac{1}{\pi}$ sec. (3) $\frac{\pi}{2}$ sec. (4) π sec.
7.	A man while going on a scooter with a speed of 10 m/sec, a child on the road and brings the scooter to stop, 4 seconds just in time to save the child. If the weight of the scooter together with the man is 200 kg, what retarding force was applied on the scooter ? (1) 300 N (2) 400 N (3) 500 N (4) 600 N
8.	If the greatest height attained by a projectile be equal to the horizontal range, then the angle of projection is given by (1) $\tan^{-1}\left(\frac{1}{4}\right)$ (2) $\tan^{-1} 4$ (3) $\tan^{-1} 2$ (4) $\tan^{-1}\left(\frac{1}{2}\right)$
9.	The differential equation of a central orbit under P as central force per unit mass, in polar form is given by : (Here $u = 1/r$ and h is constant). (1) $P = h^2 u^2\left[u + \frac{d^2u}{d\theta^2}\right]$ (2) $P = h^2 u^2\left[u + \left(\frac{du}{d\theta}\right)^2\right]$ (3) $P = h^2\left[u^2 + \left(\frac{du}{d\theta}\right)^2\right]$ (4) None of these

Question No.	Questions
10.	Which is not correct ? (1) Relative to the sun, the planets describe ellipses with the sun as one focus. (2) The radius vector drawn from the sun to a planet sweeps out areas at a constant rate (3) The square of the periodic times are proportional to the semi-major axis of the elliptic orbits and hence also to the mean distances from the sun. (4) If a particle moves under the action of a conservative system of forces, the sum of its kinetic and potential energies remain constant throughout the motion.
11.	The value of Bessel's function $J_{1/2}(x)$ is given by (1) $\sqrt{\frac{2}{\pi x}}\sin x$ (2) $\sqrt{\frac{2}{\pi x}}\cos x$ (3) $\sqrt{\frac{\pi x}{2}}\sin x$ (4) None of these
12.	If $P_n(x)$ is Legendre polynomial, then which of the following is not correct ? (1) $P_0(x) = 1$ (2) $P_1(x) = x$ (3) $P_n(-x) = (-1)^n P_n(x)$ (4) None of these
13.	The value of $\int_{-1}^{+1} P_n^2(x)\,dx$ is equal to (1) 0 (2) $\frac{2}{2n+1}$ (3) $\frac{2}{n+1}$ (4) 1

Question No.	Questions
14.	Inverse Laplace transform of $\left[\frac{s^2 - a^2}{(s^2 + a^2)^2}\right]$ is (1) t sin at (2) t cosh at (3) t cos at (4) t sinh at
15.	If $F_s(s)$ and $F_c(s)$ are Fourier sine and cosine transforms of f(t), respectively, then which is correct ? (1) $F_s[f(t) \cos at] = \frac{1}{2}[F_s(s + a) + F_s(s - a)]$ (2) $F_s[f(t) \cos at] = \frac{1}{2}[F_c(s + a) + F_c(s - a)]$ (3) $F_s[f(t) \sin at] = \frac{1}{2}[F_s(s + a) + F_s(s - a)]$ (4) None of these
16.	Which of the following symbols in C – Language represents logical operator ? (1) == (2) && (3) % (4) >=
17.	The purpose of strrev ( ) function in C – Language is to (1) Compare two strings (2) Find length of a string (3) Reverse the string (4) Copy one string over the other.
18.	Which of the following is an unconditional control transfer statement ? (1) if statement (2) goto statement (3) if-else statement (4) switch statement

Question No.	Questions

19.	Which of the following statement is incorrect ?
	(1) while (condition) {
	statement(s) ;
	}
	(2) do {
	statement(s) ;
	} while (condition) ;
	(3) switch (expression)
	{
	case exp 1 :
	statement block-1
	break ;
	case exp 2 :
	statement block-2
	break ;
	--------- 	
	--------- 	
	default :
	default block
	}
	statement t ;
	(4) None of these

20.	To send the value of variable using pointers is known as (1) Recursion (2) Call by reference (3) Getw function (4) None of these

Question No.	Questions
21.	If $x = a(\theta - \sin\theta)$; $y = a(1 - \cos\theta)$, then the value of $\frac{dy}{dx}$ will be (1) $\tan\frac{\theta}{2}$ (2) $\tan\theta$ (3) $\cot\frac{\theta}{2}$ (4) $\cot\theta$
22.	Let $f(x) = \sqrt{x^2 - 4}$, $x \in [2, 4]$, then which of the following is true for $f(x)$? (1) Roll's Theorem is applicable (2) Lagrange's Mean Value Theorem is applicable (3) There exists at least one $C = 2\sqrt{3}$ in (2, 4) (4) All the above are true.
23.	$\lim_{a \to b} \frac{a^b - b^a}{a^a - b^b}$ is (1) $\frac{1 - \log b}{1 + \log b}$ (2) $\frac{1 - \log b}{1 + \log a}$ (3) $\log\frac{a}{b}$ (4) None of these
24.	If $u = \log\left(\frac{x^2 + y^2}{x + y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to (1) 0 (2) u (3) 1 (4) e^u

Question No.	Questions
25.	Which is not correct ? (where symbols have their usual meanings in differential geometry). (1) $\frac{d\vec{t}}{ds} = k\vec{n}$ (2) $\frac{d\vec{b}}{ds} = -\tau\vec{n}$ (3) $\frac{d\vec{n}}{ds} = \tau\vec{b} - k\vec{t}$ (4) $\vec{r}' . \vec{r}''' = k^2$
26.	The particular integral of $(D^2 - 2DD')z = \sin(x + 2y)$ is (1) $\frac{1}{6}\sin(x + 2y)$ (2) $\frac{1}{3}\sin(x + 2y)$ (3) $\frac{1}{6}\cos(x + 2y)$ (4) None of these
27.	The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x\,\partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is (1) Parabolic (2) Hyperbolic (3) Elliptic (4) None of these
28.	The characteristic equations of $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x\,\partial y} - 8\frac{\partial^2 u}{\partial y^2} = 0$ are given by (1) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} - 4 = 0$ (2) $\frac{dy}{dx} - 2 = 0$ and $\frac{dy}{dx} + 4 = 0$ (3) $dy + 2\,dx = 0$ and $dy - 4\,dx = 0$ (4) None of these

Question No.	Questions
29.	The equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=\frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$ is called (1) One dimensional heat equation (2) Two dimensional heat equation (3) Two dimensional wave equation (4) Laplace equation
30.	Solution of $yp - xq = y^2 - x^2$ is (1) $\phi(x^2 + y^2, xy - z) = 0$ (2) $\phi(xy, x^2 + y^2 + z^2) = 0$ (3) $\phi\left(\frac{1}{x}-\frac{1}{y}, \frac{x-y}{z}\right) = 0$ (4) None of these
31.	The centre of the sphere $x^2 + y^2 + z^2 - 4x + 6y - 8z + 4 = 0$ is (1) $(2, -3, 4)$ (2) $(-2, 3, -4)$ (3) $(-4, 6, -8)$ (4) $(4, -6, 8)$
32.	The equation of the right circular cone whose axis is $x = y = z$, vertex is the origin and the semi-vertical angle is $45°$ is given by (1) $(x^2 + y^2 + z^2) = 3(x + y + z)^2$ (2) $2(x + y + z)^2 = 21(x^2 + y^2 + z^2)$ (3) $3(x^2 + y^2 + z^2) = 2(x + y + z)^2$ (4) $x^2 + y^2 + z^2 = \frac{1}{2}$

Question No.	Questions
33.	The equation of the cylinder, whose generators are parallel to the line $\frac{x}{1}=\frac{y}{-2}=\frac{z}{3}$ and whose guiding curve is the ellipse $x^2 + 2y^2 = 1$, $z = 0$ is given by (1) $(3z - x)^2 + 2(2z + 3y)^2 = 9$ (2) $(3x - z)^2 + 2(3y + 2z)^2 = 9$ (3) $(3x + z)^2 + 2(3y - 2z)^2 = 9$ (4) None of these
34.	The equation of the tangent to the parabola $y^2 + 4y + 20x = 0$ at (0, 0) is (1) $y = 2x$ (2) $y = 5x$ (3) $x - 5y = 0$ (4) $y + 5x = 0$
35.	The equation $\frac{x^2}{a^2}-\frac{y^2}{b^2}=\frac{2z}{c}$, represents (1) Hyperboloid of one sheet (2) Elliptic Paraboloid (3) Hyperbolic Paraboloid (4) Ellipsoid
36.	$(n^7 - n)$ is divisible by (1) 1 (2) 7 (3) 30 (4) 42
37.	Congruence $33x \equiv 22 \pmod{11}$ has (1) 3 solutions (2) 11 solutions (3) 6 solutions (4) 9 solutions
38.	If p is a prime number and 'a' denotes an integer such that (a, p) = 1, then $a^{p-1} \equiv 1 \pmod{p}$ is known as (1) Fermat's Theorem (2) Wilson's Theorem (3) Chinese Remainder Theorem (4) None of these

Question No.	Questions
39.	The value of $\frac{(\cos\theta + i\sin\theta)^6}{(\cos\theta - i\sin\theta)^4}$ is (1) 1 (2) 0 (3) $\cos 10\theta + i \sin 10\theta$ (4) $\cos 2\theta + i \sin 2\theta$
40.	Which is not correct ? (1) $\sin(ix) = i \sinh x$ (2) $\text{sech}\,\theta = \frac{2}{e^{\theta} - e^{-\theta}}$ (3) $\tanh\theta = \frac{e^{\theta} - e^{-\theta}}{e^{\theta} + e^{-\theta}}$ (4) $\cosh^2 x - \sinh^2 x = 1$
41.	With respect to standard basis vectors, a linear transformation $T : I R^4 \rightarrow IR^3$ is given by the matrix $\begin{bmatrix} 3 & -1 & -1 & 1 \\ -2 & 2 & -2 & -2 \\ -1 & 1 & 3 & -1 \end{bmatrix}$ The dimension of Ker (T) is (1) 1 (2) 2 (3) 3 (4) 4
42.	The norm of x with respect to inner product space $< x, x >$ is given by (1) $\|\|x\|\| = < x, x >$ (2) $\|\|x\|\| = < x, x >^2$ (3) $\|\|x\|\|^2 = < x, x >$ (4) None of these

Question No.	Questions
43.	Let $T : R^n \rightarrow R^n$ be a linear transformation. Which of the following statements implies that T is bijective ? (1) Rank (T) – Nullity (T) = n (2) Rank (T) + Nullity (T) = n (3) Rank (T) = Nullity (T) = n (4) None of these
44.	Let V be an inner product space, then $\|< u, v >\| \leq \|\|u\|\|.\|\|v\|\|$ for all $u, v \in V$, is known as (1) Bessel's Inequality (2) Cauchy Schwarz inequality (3) Triangle inequality (4) None of these
45.	Given that | x : | 1 | 2 | 3 | 4 | 5 | | y : | 2 | 5 | 10 | 17 | 26 | , the value of $\nabla^2 y_3$ is (1) 3 (2) 9 (3) 5 (4) 2
46.	The order of convergence of Regula-Falsi method is (1) 2 (2) 1 . 5 (3) 1. 618 (4) 2.98
47.	f (x) is given by | x : | 0 | 0.5 | 1 | 1.5 | 2.0 | | f(x) : | 1 | 0.8 | 0.5 | 0.3 | 0.1 | Then using Trapezoidal rule, the value of $\int_0^2 f(x)\,dx$ is (1) 1.075 (2) 1.575 (3) 0.775 (4) 2.150

Question No.	Questions
48.	Consider the initial value problem $\frac{dy}{dx} = -xy$; $y(0) = 1$. Then Taylor series solution upto x^4 is (1) $y = 1 + \frac{x^2}{2} + \frac{x^4}{8}$ (2) $y = x + \frac{x^2}{2} + \frac{x^4}{6}$ (3) $y = 1 + \frac{x^3}{6} + \frac{x^4}{8}$ (4) None of these
49.	The Mean and Variance are same for a distribution namely : (1) Binomial distribution (2) Poisson's distribution (3) Normal distribution (4) None of these
50.	If X follows binomial distribution with mean 3 and variance $\frac{3}{2}$, the value of $P(X \leq 5)$ is (1) $\frac{1}{64}$ (2) $\frac{1}{8}$ (3) $\frac{63}{64}$ (4) None of these
51.	If a function f be bounded on [a, b], then (1) f is necessarily R-integrable (2) f is R-integrable if $[a, b] \subset N$ (3) f is not necessarily R-integrable (4) f is R-integrable if $[a, b] = N \cup \phi$

Question No.	Questions
52.	If f be a monotonic function, then (1) f be R-integrable (2) f be R-integrable if $f \neq 0$ (3) f be bounded (4) All the above
53.	If f is integrable on [a, b] and F is the primitive of f on [a, b], then $\int_a^b f\,dx = F(b) - F(a)$ is statement of (1) First Mean Value theorem (2) Fundamental theorem of integral calculus (3) Baire's Category theorem (4) None of these
54.	The integral $\int_0^{\pi/2} \frac{\sin x}{x^n}\,dx$ converges if (1) $n < 1$ (2) $n > 1$ (3) $n > 2$ (4) $n < 2$
55.	If on a non-empty set X, $d : X \times X \to R$ be a function such that $d(x, y) = \begin{cases} 0 \text{ if } x = y \\ 1 \text{ if } x \neq y \end{cases}$, then (1) (X, d) is a semi-metric space (2) (X, d) is a metric-space (3) (X, d) is not a metric-space (4) None of these
56.	The derived set for the set $S = \left\{\frac{1}{n}; n \in N\right\}$ is (1) R (2) N (3) {0} (4) {0, ∞}

Question No.	Questions
57.	The statement "Every complete metric space is of the second category as a subset of itself" refers to (1) Baire's Category Theorem (2) Cantor's intersection Theorem (3) Bolzano-Weierstrass property (4) None of these
58.	The set $G = \{1, w, w^2\}$, where w is a cube root of unity, with respect to multiplication is a (1) Group (2) Abelian group (3) Cyclic group (4) All of these
59.	If H and K are two non-empty subsets of abelian group G, then HK is a subgroup of G if (1) H is a subgroup of G (2) K is a subgroup of G (3) $H \cap K$ is subgroup of G (4) H as well as K are subgroups of G.
60.	If p is a prime, then any group G of order 2p has (1) a normal subgroup of order p (2) a normal subgroup of order 2p (3) a normal subgroup of order p^2 (4) None of these
61.	If $u = x + y$, and $v = (x + y)^2$, then value of $\frac{\partial(u, v)}{\partial(x, y)}$ is (1) 0 (2) $4(x + y)^2$ (3) x (4) $\frac{1}{x}$

Question No.	Questions
62.	The value of Beta function $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$ is (1) $\sqrt{2\pi}$ (2) $\pi\sqrt{2}$ (3) $\sqrt{\pi}$ (4) π
63.	The area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is given by (1) πab (2) $2\pi ab$ (3) $\pi a^2 b$ (4) πab^2
64.	The Fourier series for the function $f(x) = \lvert x \rvert, -\pi \le x \le \pi$ contains (1) only sine terms (2) only cosine terms (3) both sine and cosine terms (4) None of these
65.	The Harmonic conjugate of $u(x, y) = \frac{y}{x^2+y^2}$ is (1) $\frac{x}{x^2+y^2}$ (2) $\frac{-x}{x^2+y^2}$ (3) $\frac{1}{x^2+y^2}$ (4) $x^2 - y^2$
66.	The fixed points of the mapping $w = \frac{(5Z+4)}{(Z+5)}$ are (1) 2, 2 (2) –2, –2 (3) 2, –2 (4) None of these

Question No.	Questions
67.	The bilinear transformation that maps the points $z = \infty$, i, 0 into the points $w = 0$, i and ∞ is given by (1) $w = z$ (2) $w = -z$ (3) $w = \frac{1}{z}$ (4) $w = -\frac{1}{z}$
68.	For a non-empty subset W of a vector space V(F), which of the following is incorrect ? (1) W be subspace if $u - v \in W$, $a\,u \in W$ for $u, v \in W$, $a \in F$ (2) W be subspace iff $au + bv \in W$ for $u, v \in W$; $a, b \in F$ (3) The union of any two subspaces of V(F) is a subspace (4) None of these
69.	Which of the following set form the basis of R^3 : (1) {(2, 3, 1), (7, – 6, 17), (5, 2, 7)} (2) {(2, 1, 4), (1, –1, 2), (3, 1, –2)} (3) {(1, –1, 3), (1, 2, –3), (1, 0, 1)} (4) None of these
70.	Which of the following functions T from $V_2(R)$ into $V_2(R)$ is not a linear transformation ? (1) $T(x, y) = (y, x)$ (2) $T(x, y) = (x + y, x)$ (3) $T(x, y) = (x - y, y - x)$ (4) $T(x, y) = (1 + x, y)$
71.	The resultant of two forces P and Q act at right angles to P, the angle between the forces is (1) $\cos^{-1}\left(-\frac{P}{Q}\right)$ (2) $\tan^{-1}\left(-\frac{P}{Q}\right)$ (3) $\sin^{-1}\left(-\frac{Q}{P}\right)$ (4) $\cos^{-1}\left(\frac{P}{Q}\right)$

Question No.	Questions
72.	Three forces 2P, 3P and 4P act at a point in direction parallel to the sides of an equilateral triangle taken in order. Magnitude of the resultant is (1) 3P (2) 2P (3) $\sqrt{17}$ P (4) $\sqrt{3}$ P
73.	If the normal reaction is 10 units and limiting friction is 5 units, then the coefficient of friction is (1) 2 (2) $\frac{2}{3}$ (3) $\frac{1}{2}$ (4) None of these
74.	Suppose a system of forces is reduced to a single force $\vec{R}$ and a Couple of moment $\vec{k}$ whose axis coincides with the direction of acting force, then $\vec{R}$ and $\vec{k}$ taken together are called (1) Null line (2) Wrench (3) Pitch (4) None of these
75.	The condition that the straight line $\frac{x-f}{\ell}=\frac{y-g}{m}=\frac{z-h}{n}$ may be a null line for the system of forces (X, Y, Z ; L, M, N) is (1) $\begin{vmatrix} X & Y & Z \\ \ell & m & n \\ f & g & h \end{vmatrix} = L\ell + Mm + Nn$ (2) $\begin{vmatrix} x & y & z \\ \ell & m & n \\ X & Y & Z \end{vmatrix} = -(L\ell + Mm + Nn)$ (3) $Lx + My + Nz = 0$ (4) None of these

Question No.	Questions
76.	The greatest lower bound of $\left\{\left(1+\frac{1}{n}\right)^n\right\}$ is (1) 0 (2) 2 (3) 1 (4) None of these
77.	The sequence $\left\{\frac{2n-7}{3n+2}\right\}$ is (1) Monotonic increasing, and is bounded. (2) Monotonic decreasing, and is bounded. (3) Monotonic increasing and is not bounded. (4) Monotonic decreasing and is not bounded.
78.	The series whose n^{th} term is $\left(\sqrt{n^3+1}-\sqrt{n^3}\right)$ is (1) Divergent (2) Convergent (3) Oscillatory (4) None of these
79.	If $\sum u_n$ is a series of positive terms and if $\lim_{n\to\infty}(u_n)^{1/n}=\ell$, then the series is divergent if (1) $\ell > 1$ (2) $\ell < 1$ (3) $\ell \leq 1$ (4) None of these
80.	"A series obtained from an absolutely convergent series by a rearrangement of terms converges absolutely and has the same sum as the original series", is statement of a theorem known as (1) Riemann's rearrangement theorem (2) Dirichlet's theorem (3) Pringsheim's theorem (4) Cauchy's theorem

Question No.	Questions
81.	Solution of differential equation $(y - px)^2 = 1 + p^2$, is (1) $y = cx^2 + \sqrt{1-p^2}$ (2) $y = px + \sqrt{1+p^2}$ (3) $y = px - \tan^{-1} c$ (4) $y = cx + \sqrt{1+c^2}$, is constant
82.	$P\,dx + x \sin y\,dy = 0$ is exact, then P can be (1) $\sin y + \cos y$ (2) $-\sin y$ (3) $x^2 - \cos y$ (4) $\cos y$
83.	The general solution of the differential equation $(D^2 + 6D + 9)\,y = 5\,e^{2x}$ is (1) $y = (c_1 + c_2 x)\,e^{3x} + 5\,e^{2x}$ (2) $y = (c_1 + c_2 x)\,e^{-3x} + \frac{1}{5}\,e^{2x}$ (3) $y = (c_1 + c_2 x)\,e^{-3x} + e^{2x}$ (4) $y = (c_1 + c_2 x)\,e^{3x} + \frac{e^{2x}}{3}$
84.	The solution of the differential equation $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 0$ is (1) $y = (c_1 + c_2 \log x)\,x^2$ (2) $y = (c_1 + c_2 x)\,e^{2x}$ (3) $y = c_1 x^2 + \frac{c_2}{x}$ (4) $y = (c_1 + c_2 x)\,e^{-x}$
85.	The orthogonal trajectory of family of curves $y = ax^2$ is (1) $x^2 + y^2 = a^2$ (2) $x^2 + 2y^2 = a^2$ (3) $2x^2 + y^2 = a^2$ (4) $\frac{x^2}{a^2} - \frac{y^2}{a^2} = 1$

Question No.	Questions
86.	If the vectors $2\hat{i} - \hat{j} + \hat{k}$; $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ be coplanar, then the value of a is given by (1) 1 (2) -2 (3) -3 (4) -4
87.	The value of λ so that the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector, is given by (1) 2 (2) 3 (3) -2 (4) 1
88.	Which is not correct ? (Here r, θ, z are cylindrical coordinates and $\hat{e}_r, \hat{e}_\theta, \hat{e}_z$ are unit vectors in these coordinates), (1) $\frac{d}{dt}\hat{e}_r = \dot{\theta}\,\hat{e}_\theta$ (2) $\frac{d}{dt}\hat{e}_\theta = -\dot{\theta}\,\hat{e}_r$ (3) $\hat{e}_r = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$ (4) $\hat{e}_\theta = \cos\theta\,\hat{i} - \sin\theta\,\hat{j}$
89.	If $\vec{R} = x\hat{i} + y\hat{j} + z\hat{k}$, and if S is closed surface enclosing a volume V, where $\hat{n}$ is the outward drawn unit-normal vector to the surface S, then $\iint_S \vec{R}.\hat{n}\,dS$ is equal to (1) 4V (2) 3V (3) 2V (4) V
90.	Stoke's theorem is a relation between (1) Line integral and Surface integral (2) Line integral and Volume integral (3) Surface integral and Volume integral (4) None of these

Question No.	Questions
91.	If matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$, then A^2 is equal to (1) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} -1 & -2 & -3 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ (3) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$
92.	If $A = \begin{bmatrix} 0 & 4 & -2 \\ x & 0 & -y \\ 2 & -8 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then $x - y =$ ..... is (1) 8 (2) 4 (3) -12 (4) -8
93.	If $3x + 2y + z = 0$; $x + 4y + z = 0$; $2x + y + 4z = 0$, be a system of equations, then (1) It is inconsistent (2) It can be reduced to a single equation and so a solution does not exist. (3) It has only the trivial solution $x = 0, y = 0, z = 0$ (4) The determinant of the matrix of coefficient is zero.

Question No.	Questions
94.	The condition that the cubic equation $x^3 - px^2 + qx - r = 0$ has all of its three roots equal is given by (1) $p^2 = 3qr$ (2) $q^2 = 3pr$ (3) $r^2 = 3pq$ (4) None of these
95.	Which of the following is not correct ? (1) Every square matrix satisfies its own characteristic equation. (2) If λ is an eigen-value of a matrix A, then $\frac{1}{\lambda}$ is the eigen-value of the matrix A^{-1}. (3) The sum of the eigen-values of a matrix is equal to the sum of elements of principal diagonal. (4) The matrices A and A^T have different eigen-values.
96.	Which of the following function f (x) is differentiable at the origin : (1) $f(x) = \lvert x \rvert$ (2) $f(x) = x^{2/3}$ (3) $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ (4) $f(x) = e^{-1/x^2}$
97.	The curve $2x^2 - 3xy - 2y^2 = 1$ has two asymptotes that are (1) Perpendicular (2) Parallel (3) Intersect at an angle 60° (4) None of these

Question No.	Questions
98.	The radius of curvature of the curve $y = e^x$ at the point where it crosses the y-axis is (1) 2 (2) $\frac{\sqrt{2}}{2}$ (3) $2\sqrt{2}$ (4) $\sqrt{2}$
99.	For the curve $y^2(1 + x) = x^2(1 - x)$, the origin is a (1) Cusp (2) Point of inflexion (3) Node (4) None of these
100.	The area of surface of the solid generated by the revolution of the line segment $y = 2x$ from $x = 0$ to $x = 2$, about x-axis is equal to (1) $\pi\sqrt{5}$ (2) $2\pi\sqrt{5}$ (3) $4\pi\sqrt{5}$ (4) $8\pi\sqrt{5}$

Answer Key of Mathematics Entrance CEE-2017				
Question No.	CODE-A	CODE-B	CODE-C	CODE-D
1	3	1	1	1
2	2	3	4	2
3	3	2	3	2
4	2	4	2	3
5	4	3	1	1
6	2	4	2	4
7	1	2	1	3
8	3	1	2	2
9	3	3	1	1
10	4	2	2	3
11	1	1	4	1
12	3	3	3	4
13	2	1	2	2
14	4	2	1	3
15	3	4	2	1
16	4	3	4	2
17	2	1	3	3
18	1	1	4	2
19	3	2	2	4
20	2	3	1	2
21	4	1	3	3
22	3	2	2	2
23	2	2	3	1
24	1	3	2	3
25	2	1	4	4
26	4	4	2	2
27	3	3	1	1
28	4	2	3	2
29	2	1	3	3
30	1	3	4	2
31	3	1	1	1
32	2	4	3	3
33	1	2	1	2
34	3	3	2	4
35	4	1	4	3
36	2	2	3	4
37	1	3	1	2
38	2	2	1	1
39	3	4	2	3
40	2	2	3	2
41	1	3	3	1
42	4	2	1	3
43	3	1	2	1
44	2	3	4	2
45	1	4	2	4
46	2	2	3	3
47	1	1	1	1
48	2	2	4	1
49	1	3	4	2
50	2	2	1	3

Checked & verified
24/06/17.

Answer Key of Mathematics Entrance CEE-2017				
Question No.	CODE-A	CODE-B	CODE-C	CODE-D
51	1	4	3	3
52	4	3	2	1
53	2	2	1	2
54	3	1	3	4
55	1	2	4	2
56	2	4	2	3
57	3	3	1	1
58	2	4	2	4
59	4	2	3	4
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61	3	1	1	1
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90	4	4	2	1
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92	3	4	4	2
93	1	1	2	3
94	2	2	3	2
95	4	1	1	4
96	3	3	2	2
97	1	4	3	1
98	1	3	2	3
99	2	2	4	3
100	3	4	2	4

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24/06/17