GATE SOLVED PAPER
Civil Engineering
Engineering Mathematics

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ENGINEERING MATHEMATICS

YEAR 2012 ONE MARK

Q. 1 The estimate of $\int_{0.5}^{1.5}\frac{dx}{x}$ obtained using Simpson's rule with three-point function evaluation exceeds the exact value by

(A) 0.235 (B) 0.068

(C) 0.024 (D) 0.012

Q. 2 The annual precipitation data of a city is normally distributed with mean and standard deviations as 1000 mm and 200 mm, respectively. The probability that the annual precipitation will be more than 1200 mm is

(A) $< 50\%$ (B) 50%

(C) 75% (D) 100%

Q. 3 The infinite series

$1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+\frac{x^4}{4!}+...$ corresponds to

(A) $\sec x$ (B) e^x

(C) $\cos x$ (D) $1+\sin^2 x$

YEAR 2012 TWO MARKS

Q. 4 The error in $\frac{d}{dx}f(x)\Big|_{x=x_0}$ for a continuous function estimated with $h=0.03$ using the central difference formula

$$\frac{d}{dx}f(x)\Big|_{x=x_0}=\frac{f(x_0+h)-f(x_0-h)}{2h} \text{ is } 2\times10^{-3}.$$

The values of x_0 and $f(x_0)$ are 19.78 and 500.01, respectively. The corresponding error in the central difference estimate for $h=0.02$ is approximately

(A) 1.3×10^{-4} (B) 3.0×10^{-4}

(C) 4.5×10^{-4} (D) 9.0×10^{-4}

Q. 5 In an experiment, positive and negative values are equally likely to occur. The probability of obtaining at most one negative value in five trials is

(A) $1/32$ (B) $2/32$

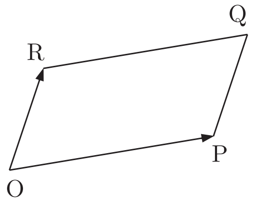
(C) $3/32$ (D) $6/32$

Q. 6 The eigen values of matrix $\begin{bmatrix}9 & 5\\5 & 8\end{bmatrix}$ are

(A) -2.42 and 6.86 (B) 3.48 and 13.53

(C) 4.70 and 6.86 (D) 6.86 and 9.50

Q. 7 For the parallelogram $OPQR$ shown in the sketch, $OP = at + bj$ and $OR = ct + dj$. The area of the parallelogram is



(A) $ad - bc$ (B) $ac + bd$
(C) $ad + bc$ (D) $ab - cd$

Q. 8 The solution of the ordinary differential equation $\frac{dy}{dx} + 2y = 0$ for the boundary condition, $y = 5$ at $x = 1$ is
(A) $y = e^{-2x}$ (B) $y = 2e^{-2x}$
(C) $y = 10.95e^{-2x}$ (D) $y = 36.95e^{-2x}$

YEAR 2011 ONE MARK

Q. 9 $[A]$ is square matrix which is neither symmetric nor skew-symmetric and $[A]^T$ is its transpose. The sum and difference of these matrices are defined as $[S] = [A] + [A]^T$ and $[D] = [A] - [A]^T$, respectively. Which of the following statements is TRUE ?
(A) Both $[S]$ and $[D]$ are symmetric
(B) Both $[S]$ and $[D]$ are skew-symmetric
(C) $[S]$ is skew-symmetric and $[D]$ is symmetric
(D) $[S]$ is symmetric and $[D]$ is skew-symmetric

Q. 10 The square root of a number N is to be obtained by applying the Newton Raphson iterations to the equation $x^2 - N = 0$. If i denotes the iteration index, the correct iterative index, the correct iterative scheme will be
(A) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{N}{x_i}\right)$ (B) $x_{i+1} = \frac{1}{2}\left(x_i^2 + \frac{N}{x_i^2}\right)$

(C) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{N^2}{x_i}\right)$ (D)$x_{i+1} = \frac{1}{2}\left(x_i - \frac{N}{x_i}\right)$

Q. 11 There are two containers, with one containing 4 red and 3 green balls and the other containing 3 blue and 4 green balls. One ball is drawn at random from each container. The probability that one of the balls is red and the other is blue will be
(A) 1/7 (B) 9/49
(C) 12/49 (D) 3/7

YEAR 2011 TWO MARKS

Q. 12 For an analytic function, $f(x + iy) = u(x, y) + iv(x, y)$, u is given by $u = 3x^2 - 3y^2$. The expression for v, considering K to be a constant is
(A) $3y^2 - 3x^2 + K$ (B) $6x - 6y + K$
(C) $6y - 6x + K$ (D) $6xy + K$

Q. 13 What should be the value of λ such that the function defined below is continuous at $x = \pi/2$?

$$f(x) = \begin{cases} \dfrac{\lambda \cos x}{\frac{\pi}{2} - x} & \text{if } x \neq \pi/2 \\ 1 & \text{if } x = \pi/2 \end{cases}$$

(A) 0 (B) $2/\pi$

(C) 1 (D) $\pi/2$

Q. 14 What is the value of the definite integral, $\int_0^a \frac{\sqrt{x}}{\sqrt{x} + \sqrt{a-x}} dx$?

(A) 0 (B) $a/2$

(C) a (D) $2a$

Q. 15 If $\boldsymbol{a}$ and $\boldsymbol{b}$ are two arbitrary vectors with magnitudes a and b, respectively, $|\boldsymbol{a} \times \boldsymbol{b}|^2$ will be equal to

(A) $a^2b^2 - (\boldsymbol{a} \cdot \boldsymbol{b})^2$ (B) $ab - \boldsymbol{a} \cdot \boldsymbol{b}$

(C) $a^2b^2 + (\boldsymbol{a} \cdot \boldsymbol{b})^2$ (D) $ab + \boldsymbol{a} \cdot \boldsymbol{b}$

Q. 16 The solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x$, with the condition that $y = 1$ at $x = 1$, is

(A) $y = \frac{2}{3x^2} + \frac{x}{3}$ (B) $y = \frac{x}{2} + \frac{1}{2x}$

(C) $y = \frac{2}{3} + \frac{x}{3}$ (D) $y = \frac{2}{3x} + \frac{x^2}{3}$

YEAR 2010 ONE MARK

Q. 17 The $\lim_{x \to 0} \frac{\sin\left[\frac{2}{3}x\right]}{x}$ is

(A) $2/3$ (B) 1

(C) $3/2$ (D) ∞

Q. 18 Two coins are simultaneously tossed. The probability of two heads simultaneously appearing is

(A) $1/8$ (B) $1/6$

(C) $1/4$ (D) $1/2$

Q. 19 The order and degree of the differential equation

$\frac{d^3y}{dx^3} + 4\sqrt{\left(\frac{dy}{dx}\right)^3 + y^2} = 0$ are respectively

(A) 3 and 2 (B) 2 and 3

(C) 3 and 3 (D) 3 and 1

YEAR 2010 TWO MARKS

Q. 20 The solution to the ordinary differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$ is

(A) $y = c_1 e^{3x} + c_2 e^{-2x}$ (B) $y = c_1 e^{3x} + c_2 e^{2x}$

(C) $y = c_1 e^{-3x} + c_2 e^{2x}$ (D) $y = c_1 e^{-3x} + c_2 e^{-2x}$

Q. 21 The inverse of the matrix $\begin{bmatrix} 3+2i & i \\ -i & 3-2i \end{bmatrix}$ is

(A) $\frac{1}{12}\begin{bmatrix} 3+2i & -i \\ i & 3-2i \end{bmatrix}$ (B) $\frac{1}{12}\begin{bmatrix} 3-2i & -i \\ i & 3+2i \end{bmatrix}$

(C) $\frac{1}{14}\begin{bmatrix} 3+2i & -i \\ i & 3-2i \end{bmatrix}$ (D) $\frac{1}{14}\begin{bmatrix} 3-2i & -i \\ i & 3+2i \end{bmatrix}$

Q. 22 The table below gives values of a function $F(x)$ obtained for values of x at intervals of 0.25.

x	0	0.25	0.5	0.75	1.0
$F(x)$	1	0.9412	0.8	0.64	0.50

The value of the integral of the function between the limits 0 to 1 using Simpson's rule is

(A) 0.7854 (B) 2.3562

(C) 3.1416 (D) 7.5000

Q. 23 The partial differential equation that can be formed from $z = ax + by + ab$ has the form (with $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$)

(A) $z = px + qy$ (B) $z = px + pq$

(C) $z = px + qy + pq$ (D) $z = qy + pq$

Q. 24 A parabolic cable is held between two supports at the same level. The horizontal span between the supports is L. The sag at the mid-span is h. The equation of the parabola is $y = 4h\frac{x^2}{L^2}$, where x is the horizontal coordinates and y is the vertical coordinate with the origin at the centre of the cable. The expression for the total length of the cable is

(A) $\int_0^L \sqrt{1 + 64\frac{h^2x^2}{L^4}}\,dx$ (B) $2\int_0^{L/2} \sqrt{1 + 64\frac{h^3x^2}{L^4}}\,dx$

(C) $\int_0^{L/2} \sqrt{1 + 64\frac{h^2x^2}{L^4}}\,dx$ (D) $2\int_0^{L/2} \sqrt{1 + 64\frac{h^2x^2}{L^4}}\,dx$

Q. 25 Given a function $f(x,y) = 4x^2 + 6y^2 - 8x - 4y + 8$ The optimal value of $f(x,y)$

(A) is a minimum equal to 10/3

(B) is a maximum equal to 10/3

(C) is a minimum equal to 8/3

(D) is a maximum equal to 8/3

YEAR 2009 ONE MARK

Q. 26 A square matrix B is skew-symmetric if

(A) $B^T = -B$ (B) $B^T = B$

(C) $B^{-T} = B$ (D) $B^{-1} = B^T$

Q. 27 For a scalar function $f(x,y,z) = x^2 + 3y^2 + 2z^2$, the gradient at the point $P(1,2,-1)$ is

(A) $2\vec{i} + 6\vec{j} + 4\vec{k}$ (B) $2\vec{i} + 12\vec{j} - 4\vec{k}$

(C) $2\vec{i} + 12\vec{j} + 4\vec{k}$ (D) $\sqrt{56}$

Q. 28 The analytic function $f(z) = \frac{z-1}{z^2+1}$ has singularity at

(A) 1 and -1 (B) 1 and i

(C) 1 and $-i$ (D) i and $-i$

YEAR 2009 TWO MARKS

Q. 29 For a scalar function $f(x,y,z) = x^2 + 3y^2 + 2z^2$, the directional derivative at the point $P(1,2,-1)$ in the direction of a vector $\vec{i} - \vec{j} + 2\vec{k}$ is

(A) -18 (B) $-3\sqrt{6}$

(C) $3\sqrt{6}$ (D) 18

Q. 30 The value of the integral $\int_C \frac{\cos(2\pi z)}{(2z-1)(z-3)}dz$ (where C is a closed curve given by $|z| = 1$) is

(A) πi (B) $\frac{\pi i}{5}$

(C) $\frac{2\pi i}{5}$ (D) πi

Q. 31 Solution of the differential equation $3y\frac{dy}{dx} + 2x = 0$ represents a family of

(A) ellipses (B) circles

(C) parabolas (D) hyperbolas

Q. 32 Laplace transform for the function $f(x) = \cosh(ax)$ is

(A) $\frac{a}{s^2 - a^2}$ (B) $\frac{s}{s^2 - a^2}$

(C) $\frac{a}{s^2 + a^2}$ (D) $\frac{s}{s^2 + a^2}$

Q. 33 In the solution of the following set of linear equations by Gauss elimination using partial pivoting $5x + y + 2z = 34$; $4y - 3z = 12$; and $10 - 2y + z = -4$; the pivots for elimination of x and y are

(A) 10 and 4 (B) 10 and 2

(C) 5 and 4 (D) 5 and -4

Q. 34 The standard normal probability function can be approximated as

$$F(x_N) = \frac{1}{1 + \exp(-1.7255x_n|x_n|^{0.12})}$$

where $x_N =$ standard normal deviate. If mean and standard deviation of annual precipitation are 102 cm and 27 cm respectively, the probability that the annual precipitation will be between 90 cm and 102 cm is

(A) 66.7% (B) 50.0%

(C) 33.3% (D) 16.7%

YEAR 2008 ONE MARK

Q. 35 The product of matrices $(PQ)^{-1}P$ is

(A) P^{-1} (B) Q^{-1}

(C) $P^{-1}Q^{-1}P$ (D) PQP^{-1}

Q. 36 The general solution of $\frac{d^2y}{dx^2} + y = 0$ is

(A) $y = P\cos x + Q\sin x$
(B) $y = P\cos x$
(C) $y = P\sin x$
(D) $y = P\sin^2 x$

YEAR 2008 TWO MARKS

Q. 37 The equation $k_x \frac{\partial^2 h}{\partial x^2} + k_z \frac{\partial^2 h}{\partial z^2} = 0$ can be transformed to $\frac{\partial^2 h}{\partial x_t^2} + \frac{\partial^2 h}{z^2} = 0$ by substituting

(A) $X_t = X\frac{k_z}{k_x}$
(B) $X_t = X\frac{k_x}{k_z}$
(C) $X_t = x\sqrt{\frac{k_x}{k_z}}$
(D) $X_t = x\sqrt{\frac{k_z}{k_x}}$

Q. 38 The value of $\int_0^3\int_0^x (6 - x - y)\,dxdy$ is

(A) 13.5
(B) 27.0
(C) 40.5
(D) 54.0

Q. 39 Three values of x and y are to be fitted in a straight line in the form $y = a + bx$ by the method of least squares. Given $\Sigma x = 6, \Sigma y = 21, \Sigma x^2 = 14$ and $\Sigma xy = 46$, the values of a and b are respectively

(A) 2 and 3
(B) 1 and 2
(C) 2 and 1
(D) 3 and 2

Q. 40 Solution of $\frac{dy}{dx} = -\frac{x}{y}$ at $x = 1$ and $y = \sqrt{3}$ is

(A) $x - y^2 = -2$
(B) $x + y^2 = 4$
(C) $x^2 - y^2 = -2$
(D) $x^2 + y^2 = 4$

Q. 41 If probability density function of random variable X is

$$f(x) = x^2 \text{ for } -1 \le x \le 1, \text{ and}$$
$$= 0 \text{ for any other value of } x$$

then, the percentage probability $P\left(-\frac{1}{3} \le x \le \frac{1}{3}\right)$ is

(A) 0.247
(B) -6 and 5
(C) 3 and 4
(D) 1 and 2

Q. 42 The Eigen values of the matrix $[P] = \begin{bmatrix} 4 & 5 \\ 2 & -5 \end{bmatrix}$ are

(A) –7 and 8
(B) –6 and 5
(C) 3 and 4
(D) 1 and 2

Q. 43 A person on a trip has a choice between private car and public transport. The probability of using a private car is 0.45. While using the public transport, further choices available are bus and metro, out of which the probability of commuting by a bus is 0.55. In such a situation, the probability (rounded up to two decimals) of using a car, bus and metro, respectively would be

(A) 0.45, 0.30 and 0.25
(B) 0.45, 0.25 and 0.30
(C) 0.45, 0.55 and 0.00
(D) 0.45, 0.35 and 0.20

Q. 44 The following simultaneous equations

$$\begin{aligned} x+y+z &= 3 \\ x+2y+3z &= 4 \\ x+4y+kz &= 6 \end{aligned}$$

will NOT have a unique solution for k equal to

(A) 0 (B) 5

(C) 6 (D) 7

Q. 45 The inner (dot) product of two vectors $\vec{P}$ and $\vec{Q}$ is zero. The angle (degrees) between the two vectors is

(A) 0 (B) 30

(C) 90 (D) 120

YEAR 2007 ONE MARK

Q. 46 The minimum and the maximum eigen values of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are -2 and 6, respectively. What is the other eigen value ?

(A) 5 (B) 3

(C) 1 (D) -1

Q. 47 The degree of the differential equation $\frac{d^2x}{dt^2} + 2x^3 = 0$ is

(A) 0 (B) 1

(C) 2 (D) 3

Q. 48 The solution for the differential equation $\frac{dy}{dx} = x^2 y$ with the condition that $y = 1$ at $x = 0$ is

(A) $y = e^{\frac{1}{2x}}$ (B) $\ln(y) = \frac{x^3}{3} + 4$

(C) $\ln(y) = \frac{x^2}{2}$ (D) $y = e^{\frac{x^3}{3}}$

YEAR 2007 TWO MARKS

Q. 49 For the values of a and b the following simultaneous equations have an infinite number of solutions ?

$x+y+z = 5;\ \ x+3y+3z = 9;\ \ x+2y+\alpha z = \beta$

(A) 2,7 (B) 3,8

(C) 8,3 (D) 7,2

Q. 50 A velocity vector is given as $\vec{V} = 5xy\vec{i} + 2y^2\vec{j} + 3yz^2\vec{k}$. The divergence of this velocity vector at $(1,1,1)$ is

(A) 9 (B) 10

(C) 14 (D) 15

Q. 51 A body originally at 60°C cools down to 40°C in 15 minutes when kept in air at a temperature 25°C. What will be the temperature of the body at the end of 30 minutes ?

(A) 35.2°C (B) 31.5°C

(C) 28.7°C (D) 15°C

Q. 52 The following equation needs to be numerically solved using the Newton-Raphson method.

$$x^3 + 4x - 9 = 0$$

The iterative equation for this purpose is (k indicates the iteration level)

(A) $X_{k+1} = \frac{2X_k^3 + 9}{3X_k^2 + 4}$ (B) $X_{k+1} = \frac{3X_k^2 + 4}{2X_k^2 + 9}$

(C) $X_{k+1} = X_k - 3X_k^2 + 4$ (D) $X_{k+1} = \frac{4X_k^2 + 3}{9X_k^2 + 2}$

Q. 53 Evaluate $\int_0^{\infty} \frac{\sin t}{t} dt$

(A) π (B) $\frac{\pi}{2}$

(C) $\frac{\pi}{4}$ (D) $\frac{\pi}{8}$

Q. 54 Potential function ϕ is given as $\phi = x^2 - y^2$. What will be the stream function (Ψ) with the condition $\Psi = 0$ at $x = y = 0$?

(A) $2xy$ (B) $x^2 + y^2$

(C) $x^2 - y^2$ (D) $2x^2y^2$

Q. 55 The inverse of the 2×2 matrix $\begin{bmatrix} 1 & 2 \\ 5 & 7 \end{bmatrix}$ is

(A) $\frac{1}{3}\begin{bmatrix} -7 & 2 \\ 5 & -1 \end{bmatrix}$ (B) $\frac{1}{3}\begin{bmatrix} 7 & 2 \\ 5 & 1 \end{bmatrix}$

(C) $\frac{1}{3}\begin{bmatrix} 7 & -2 \\ -5 & 1 \end{bmatrix}$ (D) $\frac{1}{3}\begin{bmatrix} -7 & -2 \\ -5 & -1 \end{bmatrix}$

Q. 56 Given that one root of the equation $x^3 - 10x^2 + 31x - 30 = 0$ is 5, the other two roots are

(A) 2 and 3 (B) 2 and 4

(C) 3 and 4 (D) -2 and -3

Q. 57 If the standard deviation of the spot speed of vehicles in a highway is 8.8 kmph and the mean speed of the vehicles is 33 kmph, the coefficient of variation in speed is

(A) 0.1517 (B) 0.1867

(C) 0.2666 (C) 0.3446

YEAR 2006 ONE MARK

Q. 58 Solution for the system defined by the set of equations $4y + 3z = 8$; $2x - z = 2$ and $3x + 2y = 5$ is

(A) $x = 0; y = 1; z = \frac{4}{3}$ (B) $x = 0; y = \frac{1}{2}; z = 2$

(C) $x = 1; y = \frac{1}{2}; z = 2$ (D) non-existent

Q. 59 The differential equation $\frac{dy}{dx} = 0.25y^2$ is to be solved using the backward (implicit) Euler's method with the boundary condition $y = 1$ at $x = 0$ and with the a step size of 1. What would be the value of y at $x = 1$?

(A) 1.33 (B) 1.67

(C) 2.00 (D) 2.33

YEAR 2006 TWO MARKS

Q. 60 For a given matrix $A = \begin{bmatrix} 2 & -2 & 3 \\ -2 & -1 & 6 \\ 1 & 2 & 0 \end{bmatrix}$, one of the eigenvalues is 3.
The other two eigenvalues are

(A) 2, – 5 (B) 3, – 5

(C) 2, 5 (D) 3, 5

Q. 61 The directional derivative of $f(x,y,z) = 2x^2 + 3y^2 + z^2$ at the point $P(2,1,3)$ in the direction of the vector $a = i - 2k$ is

(A) -2.785 (B) -2.145

(C) -1.789 (D) 1.000

Q. 62 A class of first year B. Tech. students is composed of four batches A, B, C and D, each consisting of 30 students. It is found that the sessional marks of students in Enginnering Drawing in batch C havea mean of 6.6 and standard deviation of 2.3. The mean and standard deviation of the marks for the entire class are 5.5 and 4.2, respectively. It is decided by the course instructor to normalize the marks of the students of all batches to have the same mean and standard deviation as that of the entire class. Due to this, the marks of a student in batch C are changed from 8.5 to

(A) 6.0 (B) 7.0

(C) 8.0 (D) 9.0

Q. 63 A 2^{nd} degree polynomial, $f(x)$ has values of 1, 4 and 15 at $x = 0$, 1 and 2, respectively. The integral $\int_0^2 f(x)\,dx$ is to be estimated by applying the trapezoidal rule to this data. What is the error (defined as " true value - approximate value") in the estimate ?

(A) $-\frac{4}{3}$ (B) $-\frac{2}{3}$

(C) 0 (D) $\frac{2}{3}$

Q. 64 What is the area common to the circles $r = a$ and $r = 2a\cos\theta$?

(A) 0.524 a^2 (B) 0.614 a^2

(C) 1.047 a^2 (D) 1.228 a^2

Q. 65 Using Cauchy's integral theorem, the value of the integral (integration being taken in counterclockwise direction) $\oint_c \frac{z^3 - 6}{3z - i}\,dz$ is

(A) $\frac{2\pi}{81} - 4\pi i$ (B) $\frac{\pi}{8} - 6\pi i$

(C) $\frac{4\pi}{81} - 6\pi i$ (D) 1

Q. 66 There are 25 calculators in a box. Two of them are defective. Suppose 5 calculators are randomly picked for inspection (i.e. , each has the same chance of being selected), what is the probability that only one of the defective calculators will be included in the inspection ?

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{1}{4}$ (D) $\frac{1}{5}$

Q. 67 A spherical naphthalene ball exposed to the atmosphere losses volume at a rate proportional to its instantaneous surface are due to evaporation. If the initial diameter of the ball is 2 m and the diameter reduces to 1 cm after 3 months, the ball completely evaporates in

(A) 6 months (B) 9 months

(C) 12 months (D) Infinite time

Q. 68 The solution of the differential equation, $x^2\frac{dy}{dx}+2xy-x+1=0$, given that at $x=1$, $y=0$ is

(A) $\frac{1}{2}-\frac{1}{x}+\frac{1}{2x^2}$ (B) $\frac{1}{2}-\frac{1}{x}-\frac{1}{2x^2}$

(C) $\frac{1}{2}+\frac{1}{x}+\frac{1}{2x^2}$ (D) $-\frac{1}{2}+\frac{1}{x}+\frac{1}{2x^2}$

YEAR 2005 ONE MARK

Q. 69 Consider the matrices $X_{(4\times3)}$, $Y_{(4\times3)}$ and $P_{(2\times3)}$.
The order of $[P(X^TY)^{-1}P^T]^T$ will be

(A) (2×2) (B) (3×3)

(C) (4×3) (D) (3×4)

Q. 70 Consider a non-homogeneous system of linear equations representing mathematically an over-determined system. Such a system will be

(A) consistent having a unique solution

(B) consistent having a unique solution

(C) inconsistent having a unique solution

(D) inconsistent having no solution

Q. 71 Which one of the following is NOT true for complex number Z_1 and Z_2 ?

(A) $\frac{Z_1}{Z_2}=\frac{Z_1\bar{Z}_2}{|Z_2|^2}$

(B) $|Z_1+Z_2|\le|Z_1|+|Z_2|$

(C) $|Z_1-Z_2|\le|Z_1|-|Z_2|$

(D) $|Z_1+Z_2|^2+|Z_1-Z_2|^2=|Z_1|^2+2|Z_2|^2$

Q. 72 Which one of the following statement is NOT true ?

(A) The measure of skewness is dependent upon the amount of dispersion

(B) In a symmetric distribution, the values of mean, mode and median are the same

(C) In a positively skewed distribution : mean > median > mode

(D) In a negatively skewed distribution : mode > mean > median

YEAR 2005 TWO MARKS

Q. 73 Consider the system of equation $A_{(n \times n)} X_{(n \times t)} = \lambda_{(n \times 1)}$ where, λ is a scalar. Let (λ_i, X_i) be an eigen-pair of an eigen value and its corresponding eigen vector for real matrix A. Let be a $(n \times n)$ unit matrix. Which on of the following statement is NOT correct ?

(A) For a homogeneous $n \times n$ system of linear equations, $(A - \lambda I)x = 0$ having a nontrivial solution, the rank of $(A - \lambda I)$ is less than n.

(B) For matrix A^m, m being a positive integer, (λ_i^m, X_i^m) will be the eigen-pair for all i.

(C) If $A^T = A^{-1}$, then $|\lambda_i| = 1$ for all i

(D) If $A^T = A$, then λ_i is real for all i

Q. 74 Transformation to linear form by substituting $v = y^{1-n}$ of the equation $\frac{dy}{dt} + p(t)y = q(t)y^n; n > 0$ will be

(A) $\frac{dv}{dt} + (1-n)pv = (1-n)q$

(B) $\frac{dv}{dt} + (1-n)pv = (1-n)q$

(C) $\frac{dv}{dt} + (1+n)pv = (1-n)q$

(D) $\frac{dv}{dt} + (1+n)pv = (1+n)q$

Q. 75 A rail engine accelerates from its stationary position for 8 seconds and travels a distance of 280 m. According to the Mean Value Theorem, the speedometer at a certain time during acceleration must read exactly

(A) 0

(B) 8 kmph

(C) 75 kmph

(D) 126 kmph

Q. 76 The solution of $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 17y = 0; y(0) = 1, \frac{dy}{dx}\left(\frac{x}{4}\right) = 0$ in the range $0 < x < \frac{\pi}{4}$ is given by

(A) $e^{-x}\left(\cos 4x + \frac{1}{4}\sin 4x\right)$

(B) $e^{x}\left(\cos 4x - \frac{1}{4}\sin 4x\right)$

(C) $e^{-4x}\left(\cos x - \frac{1}{4}\sin x\right)$

(D) $e^{-4x}\left(\cos 4x - \frac{1}{4}\sin 4x\right)$

Q. 77 Value of the integral $\oint_c (xydy - y^2dx)$, where , c is the square cut from the first quadrant by the line $x = 1$ and $y = 1$ will be (Use Green's theorem to change the line integral into double integral)

(A) $\frac{1}{2}$

(B) 1

(C) $\frac{3}{2}$

(D) $\frac{5}{3}$

Q. 78 Consider the likely applicability of Cauchy's Integral Theorem to evaluate the following integral counter clockwise around the unit circle c.

$$I = \oint_c \sec z dz,$$

z being a complex variable. The value of I will be

(A) $I = 0$: singularities set $= \phi$

(B) $I = 0$: singularities set $= \left\{\pm\frac{2n+1}{2}\pi, n = 0, 1, 2..............\right\}$

(C) $I = \pi/2$: singularities set $= \{\pm n\pi; n = 0, 1, 2...............\}$

(D) None of above

Statement for Linked Q. 79 and 80 :

Give a > 0, we wish to calculate its reciprocal value 1/a by using Newton Raphson Method for $f(x) = 0$.

Q. 79 The Newton Raphson algorithm for the function will be

(A) $X_{k+1} = \frac{1}{2}\left(X_k + \frac{a}{X_k}\right)$
(B) $X_{k+1} = \left(X_k + \frac{a}{2}X_k^2\right)$
(C) $X_{k+1} = 2X_k = aX_k^2$
(D) $X_{k+1} = X_k - \frac{a}{2}X_k^2$

Q. 80 For $a = 7$ and starting with $x_0 = 0.2$, the first two iterations will be

(A) 0.11, 0.1299
(B) 0.12,0.1392
(C) 0.12, 0.1416
(D) 0.13, 0.1428

YEAR 2004 ONE MARK

Q. 81 Real matrices $[A]_{3\times 1}, [B]_{3\times 3}, [C]_{3\times 5}, [D]_{5\times 5}$ and $[F]_{5\times 1}$ are given. Matrices [B] and [E] are symmetric.

Following statements are made with respect to these matrices.

1. Matrix product $[F]^T[C]^T[B][C][F]$ is a scalar.
2. Matrix product $[D]^T[F][D]$ is always symmetric.

With reference to above statements, which of the following applies ?

(A) Statement 1 is true but 2 is false
(B) Statement 1 is false but 2 is true
(C) Both the statement are true
(D) Both the statement are false

Q. 82 The summation of series $S = 2 + \frac{5}{2} + \frac{8}{2^2} + \frac{11}{2^3} + \text{...........}\infty$ is

(A) 4.50
(B) 6.0
(C) 6.75
(D) 10.0

Q. 83 The value of the function $f(x) = \lim_{x\to 0}\frac{x^3 + x^2}{2x^3 - 7x^2}$ is

(A) 0
(B) $-\frac{1}{7}$
(C) $\frac{1}{7}$
(D) ∞

YEAR 2004 TWO MARKS

Q. 84 The eigenvalues of the matrix $\begin{bmatrix} 4 & -2 \\ -2 & 1 \end{bmatrix}$

(A) are 1 and 4
(B) are -1 and 2
(C) are 0 and 5
(D) cannot be determined

Q. 85 The function $f(x) = 2x^3 - 3x^2 - 36x + 2$ has its maxima at

(A) $x = -2$ only
(B) $x = 0$ only
(C) $x = 3$ only
(D) both $x = -2$ and $x = 3$

Q. 86 Biotransformation of an organic compound having concentration (x) can be modeled using an ordinary differential equation $\frac{dx}{dt} + kx^2 = 0$, where k is the reaction rate constant, If $x = a$ at $t = 0$, the solution of the equation is

(A) $x = ae^{-kt}$ (B) $\frac{1}{x} = \frac{1}{a} + kt$

(C) $x = a(1 - e^{-kt})$ (D) $x = a + kt$

Q. 87 A hydraulic structure has four gates which operate independently. The probability of failure of each gate is 0.2. Given that gate 1 has failed, the probability that both gates 2 and 3 will fail is

(A) 0.240 (B) 0.200

(C) 0.040 (D) 0.008

YEAR 2003 ONE MARK

Q. 88 Given Matrix $[A] = \begin{bmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 1 \end{bmatrix}$, the rank of the matrix is

(A) 4 (B) 3

(C) 2 (D) 1

Q. 89 A box contains 10 screws, 3 of which are defective. Two screws are drawn at random with replacement. The probability that none of the two screws is defective will be

(A) 100% (B) 50%

(C) 49% (D) None of these

Q. 90 If P, Q and R are three points having coordinates $(3, -2, -1)$, $(1, 3, 4)$, $(2, 1 - 2)$ in XYZ space, then the distance from point P to plane OQR (O being the origin of the coordinate system) is given by

(A) 3 (B) 5

(C) 7 (D) 9

YEAR 2003 TWO MARK

Q. 91 If L defines the Laplace Transform of a function, $L[\sin(at)]$ will equal to

(A) $\frac{a}{s^2 - a^2}$ (B) $\frac{a}{s^2 + a^2}$

(C) $\frac{s}{s^2 + a^2}$ (D) $\frac{s}{s^2 - a^2}$

Q. 92 The Fourier series expansion of a symmetric and even function, $f(x)$ where

$$f(x) = 1 + (2x/\pi),\ -\pi \le x \le 0$$

and $$= 1 - (2x/\pi),\ 0 \le x \le \pi$$

will be

(A) $\sum_{n=1}^{\infty} \frac{4}{\pi^2 n^2}(1 + \cos n\pi)$ (B) $\sum_{n=1}^{\infty} \frac{4}{\pi^2 n^2}(1 - \cos n\pi)$

(C) $\sum_{n=1}^{\infty} \frac{4}{\pi^2 n^2}(1 - \sin n\pi)$ (D) $\sum_{n=1}^{\infty} \frac{4}{\pi^2 n^2}(1 + \sin n\pi)$

YEAR 2001 ONE MARK

Q. 93 A vector normal to $\hat{i} + 2\hat{j} - \hat{k}$ is

(A) $\hat{i} - \hat{j} - \hat{k}$
(B) $-\hat{i} - 2\hat{j} + \hat{k}$
(C) $-\hat{i} + 2\hat{j} + \hat{k}$
(D) $2\hat{i} + \hat{j} - 2\hat{k}$

Q. 94 The necessary condition to diagonalise a matrix is that

(A) its eigen value should be distinct
(B) its eigen vectors should be independent
(C) its eigen value should be real
(D) the matrix is non-singular

YEAR 2001 TWO MARKS

Q. 95 $\lim_{x \to \frac{\pi}{4}} \frac{\sin^2\left(x - \frac{\pi}{4}\right)}{x - \frac{\pi}{4}}$ equals

(A) 0
(B) 1/2
(C) 1
(D) 2

YEAR 2000 ONE MAKR

Q. 96 The rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 6 & 8 \end{bmatrix}$, is

(A) 0
(B) 1
(C) 2
(D) 3

YEAR 2000 TWO MARKS

Q. 97 The characteristic roots of the system described as $\frac{dx}{dt} = y$, $\frac{dy}{dt} = -x$ are at

(A) $+1, +1$
(B) $-1, +1$
(C) $-j, +j$
(D) None of the above

Q. 98 For a singular matrix,

(A) at least one eigen value would be at the origin
(B) all eigen values would be at the origin
(C) no eigen value would be at the origin
(D) None of the above

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ANSWER KEY

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