NG 16 (GROUP A)

PART AA — ENGINEERING MATHEMATICS

(Common to all candidates)

(Answer ALL questions)

1. If $A = \begin{pmatrix} 1 & -2 \\ -5 & 4 \end{pmatrix}$, then the eigenvalues of $adj(A)$ are

   1. $1, -6$
   2. $1, 6$
   3. $-1, 1/6$
   4. $-1, 6$

2. A system of equations $x + y + z = 6$, $x + 2y + 3z = 10$ and $x + 2y + kz = 5$ has no solution if the value of 'k' is

   1. 5
   2. 3
   3. 4
   4. 1

3. If the matrix $A = \begin{pmatrix} -1 & 3 \\ 2 & 4 \end{pmatrix}$ satisfies its own characteristic equation, then the matrix $A^4 - 3A^3 - 10A^2 + 3A + 2I$ is of the form

   1. $\begin{pmatrix} -1 & 9 \\ 6 & 14 \end{pmatrix}$
   2. $\begin{pmatrix} -5 & 9 \\ 6 & 10 \end{pmatrix}$
   3. $\begin{pmatrix} 1 & 3 \\ 2 & 6 \end{pmatrix}$
   4. $\begin{pmatrix} 0 & 3 \\ 2 & 5 \end{pmatrix}$

4. If $x = u(1+v)$ and $y = v(1+u)$, then the Jacobian of x, y with respect to u, v is given by

   1. $2u + v + 1$
   2. $u + 2v + 1$
   3. $u + v + 1$
   4. $u - v + 1$

5. The possible extreme point of a function $f(x, y) = x^2 + y^2 + \frac{2}{x} + \frac{2}{y}$ is

   1. $(0, 0)$
   2. $(-1, -1)$
   3. $(1/3, 1/3)$
   4. $(1, 1)$

6. The nature of the stationary point (1, 1) of the function $f(x, y) = (xy)^3$ is

   1. a saddle point
   2. a minimum point
   3. a maximum point
   4. an invariant point

7. By eliminating x from the simultaneous linear equations $\frac{dx}{dt}+2y=0$, $\frac{dy}{dt}-2x=0$, the differential equation is of the form

1. $\frac{d^2y}{dt^2}=4y$
2. $\frac{d^2y}{dt^2}=2y$
3. $\frac{d^2y}{dt^2}+4y=0$
4. $\frac{d^2y}{dt^2}+2y=0$

8. The particular integral of $(D^2-4D+13)y=e^{2x}\cos 3x$ is

1. $x e^{2x}\sin 3x$
2. $\frac{1}{6}x e^{2x}\sin 3x$
3. $\frac{1}{3}x e^{2x}\sin 3x$
4. $\frac{1}{18}e^{2x}\cos 3x$

9. The value of the integral $\int_C (y^2\,dx - x^2\,dy)$, where C is the boundary of the triangle whose vertices are $(-1, 0)$, $(1, 0)$ and $(0, 1)$ is

1. $\frac{1}{3}$
2. $\frac{2}{3}$
3. $\frac{3}{2}$
4. $-\frac{2}{3}$

10. The work done by the force $\vec{F}=3x\,\vec{i}+4y\,\vec{j}$ when it moves a particle on the curve $2y=x^2$ from (0, 0) to (2, 2) is

1. 14
2. 2
3. 6
4. 8

11. If $v=x^3-kxy^2+3x+5$ is the imaginary part of a function $f(z)=u+iv$, then v is harmonic only when 'k' is equal to

1. −3
2. 3
3. 2
4. −1

12. The invariant point of the transformation $w=\frac{3z-5i}{iz-1}$ is given by

1. $5i$
2. $-i$
3. $-5i$
4. 1

13. The value of the integral $\int_C \frac{dz}{(z-2)^2}$, where C is the circle whose centre is 2 and radius 4 is

1. $2\pi i$
2. $4\pi i$
3. $-2\pi i$
4. 0

14. The partial differential equation by eliminating the arbitrary function 'f' from $z = f\left(\frac{x}{y}\right)$ is of the form

1. $py + qx = 0$
2. $px + qy = 0$
3. $qx - py = 0$
4. $qy = px = 0$

15. If $L\{f(t)\} = \frac{1}{s(s+a)}$, then $f(t)$ is equal to

1. ae^{-at}
2. $(1-e^{-at})$
3. $\frac{1}{a}(1-e^{-at})$
4. $\frac{1}{a}e^{-at}$

16. If $F(s)$ is the Fourier transform of a function $f(x)$, then the Fourier transform of $f(2x)$ is

1. $F(s-2)$
2. $e^{2is}F(s)$
3. $\frac{1}{2}F(2/s)$
4. $\frac{1}{2}F(s/2)$

17. The Z-transform of the unit step function $u(n) = \begin{cases} 0 & \text{if } n < 0 \\ 1 & \text{if } n \geq 0 \end{cases}$ is

1. $z-1$
2. $\frac{z}{z-1}$
3. $\frac{1}{z-1}$
4. 1

18. In solving the system $Ax = B$ of linear equations by Gauss Jordan method, the coefficient matrix A is reduced to

1. symmetric matrix
2. orthogonal matrix
3. diagonal matrix
4. null matrix

19. The probability density function of a continuous random variable X is given by $f(x) = \begin{cases} (k/x^3) & \text{if } 5 \leq x \leq 10 \\ 0 & \text{otherwise} \end{cases}$. Then the value of '$k$' is

1. $\frac{3}{200}$
2. $\frac{200}{3}$
3. 200
4. 40

20. The moment generating function about the origin of a Binomial distribution with 'n' observations, probability of success 'p' and probability of failure 'q' is of the form

1. $(pe^t + q)^n$
2. $(1 + pe^t)^n$
3. $(pe^t + q)^{-n}$
4. $(pq + e^t)^n$