

NG 20 (GROUP A)

PART I — ENGINEERING MATHEMATICS

(Common to all candidates)

(Answer ALL questions)

- The eigen value of $\begin{bmatrix} 2 & 3 \\ 0 & 4 \end{bmatrix}$ corresponding to the eigen vector $[1, 0]^T$ is
 - 1
 - 2
 - 3
 - 4
- If $y_1 = \frac{x_2 x_3}{x_1}$, $y_2 = \frac{x_3 x_1}{x_2}$, $y_3 = \frac{x_1 x_2}{x_3}$ then the value of $\frac{\partial (y_1, y_2, y_3)}{\partial (x_1, x_2, x_3)}$ is
 - 2
 - 2
 - 3
 - 4
- The complete integral of $pz^2 \sin^2 x + 9z^2 \cos^2 y = 1$ is
 - $3a \cos x + 3(1-a) \sin y + b$
 - $-3a \cos x + 3(1-a) \tan y + b$
 - $-3a \cot x - 3(1-a) \tan y + b$
 - $-3a \cot x + 3(1-a) \tan y + b$
- If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then the value of $\nabla^2(\log r)$ is
 - r^2
 - $\frac{2}{r^2}$
 - $2r^2$
 - $\frac{1}{r^2}$
- The complex numbers $z_1 = 1 + 2i$, $z_2 = 4 - 2i$ and $z_3 = 1 - 6i$ form the vertices of
 - Right angle triangle
 - Isosceles triangle
 - Equilateral triangle
 - Scalene triangle
- If f has an isolated singularity at $z = a$ and $f(z) = \sum_{n=-\infty}^{\infty} a_n(z-a)^n$ is its Laurent's expansion about $z = a$. Then residue of f at $z = a$ is
 - a_{-1}
 - a_0
 - a_{-2}
 - a_1
- The Laplace transform of $\int_0^t \frac{e^t \sin t}{t} dt$ is
 - $\frac{1}{s} \left[\frac{\pi}{2} - \tan^{-1}(s-1) \right]$
 - $\frac{1}{s} \left[\frac{\pi}{2} - \sin^{-1}(s-1) \right]$
 - $\frac{1}{s} \left[\frac{\pi}{2} - \cos^{-1}(s-1) \right]$
 - $\frac{1}{s} \left[\frac{\pi}{2} - \cot^{-1}(s-1) \right]$

8. Let h be the finite difference, factorial notation, is defined as

- $x^{(n)} = x(x-h)(x-2h)\dots(x-\overline{n-1}h)$
- $x^{(n)} = \frac{x!}{(x-n)!}, (n < x)$
- Both (a) and (b)
- None of these

9. If the random variable X has a probability generating function $P_x(t)$. The probability generating function of $2x$ is

- $P_x(t^2)$
- $P_x(t)$
- $P_x(1-t)$
- $P_x(t^3)$

10. A random sample of 100 observations is to be drawn from a population with a mean of 40 and a standard deviation of 25. The probability that the mean of the sample will exceed 45 is

- 0.4772
- 0.4207
- 0.0793
- 0.0228

11. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ then the expression

$(2A^5 - 3A^4 + A^2 - 4I_2)$ as a linear polynomial in A is

- $138A - 403I_2$
- $138 + 403I_2$
- $138A - 403I_1$
- $138 + 403I_1$

12. If $x^y = y^x$ then the value of $\frac{dy}{dx}$ is

- $\frac{y(y-x \log y)}{x(x-y \log x)}$
- $\frac{y(x+y \log x)}{x(y+x \log y)}$
- $\frac{y+x \log y}{x+y \cos x}$
- None of these

13. If $\vec{r}$ the position vector, then the value of $\text{dir } \hat{r}$ is

- r
- $\frac{1}{r}$
- $\frac{2}{r}$
- $\frac{3}{r}$

14. The radius of convergence of the power series $f(z) = \sum \frac{n+1}{(n+2)(n+3)} z^n$ is
- 1
 - 2
 - 3
 - 4
15. If G is simply connected and $f: G \rightarrow \mathbb{C}$ is an analytic in G , then
- f has a primitive in G
 - f has a no primitive in G
 - f is constant in G
 - None of these
16. The branch of logarithmic function is
- Continuous function
 - Differentiable function
 - Analytic function
 - None of these
17. The Laplace transform of $\left[e^{2t} \int_0^t \frac{\sin 3t}{t} dt \right]$ is
- $\frac{1}{S-2} \cot^{-1} \left[\frac{S-2}{3} \right]$
 - $\frac{1}{S-2} \cot^{-1} \left[\frac{S+2}{3} \right]$
 - $\frac{1}{S-3} \cot^{-1} \left[\frac{S-3}{2} \right]$
 - $\frac{1}{S-3} \cot^{-1} \left[\frac{S+3}{2} \right]$
18. In interpolation, if $x_0, x_1, x_2, \dots$ are $(n+1)$ distinct value of a real valued function $f(x)$ then
- one has a polynomial $p_n(x_i) = f(x)$ of degree n or more.
 - one has a polynomial $p_n(x_i) = f(x)$ of degree n exactly
 - one has a polynomial $p_n(x_i) = f(x)$ of degree n or less
 - None of these
19. The moment generating function of the random variable X , whose moments are $\mu'_r = (r+1) 2^r$ is
- $(1-2t)^{-1}$
 - $(1-2t)$
 - $2t$
 - $\frac{1}{2t}$
20. The probability of getting doublets when two dice are thrown simultaneously is
- $\frac{1}{2}$
 - $\frac{1}{3}$
 - $\frac{1}{6}$
 - $\frac{2}{3}$