Reg. No. : | | | | | | | | | | |

Question Paper Code: 42002

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Second Semester

Civil Engineering

14UMA202 - ENGINEERING MATHEMATICS – II

(Common to ALL Branches)

(Regulation 2014)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. The roots of $(D^2+2)y$ are

   (a) ± 2 (b) $\pm 2i$ (c) $\pm i\sqrt{2}$ (d) $\sqrt{2}$

2. The particular integral of $(4D^2 - 4D + 1)y = 4$ is

   (a) -4   (b) 4   (c) -2   (d) -3

3. The gradient of a scalar function is defined as

   (a) $\nabla/\emptyset$ (b) $\nabla * \emptyset$ (c) $\emptyset\nabla$ (d) $\nabla\emptyset$

4. By stokes theorem, $\int_c \vec{r}\, d\vec{r} =$ _______

   (a) π (b) 1   (c) 0   (d) None of these

5. The derivative of f(z) at z_0 is

   (a) l (b) f(z)   (c) $f(z_0)$ (d) $f'(z_0)$

6. The invariant points of $w = \frac{2z-5}{z+4}$ are

(a) $z = 2, -1$ (b) $z = -1 \pm 2i$ (c) $z = 0,1$ (d) $z = 2 \pm 3i$

7. Which of the following is not an analytic function?

(a) $\sin z$ (b) z (c) $\sinh z$ (d) $\bar{z}$

8. Conformal mapping is a mapping which preserves angle

(a) in magnitude (b) in sense

(c) both in magnitude and sense (d) Either in magnitude or in sense

9. $L^{-1}\left[\frac{1}{s^2 + a^2}\right] =$

(a) $\frac{\sinh at}{a}$ (b) $\frac{\sin at}{a}$ (c) $\sinh at$ (d) $\sin at$

10. Laplace transforms is an ________ transform.

(a) Discrete (b) Discrete time

(c) Data independent (d) Integral

PART - B (5 x 2 = 10 Marks)

11. Solve $(D^4 - 2D^3 + D^2)y = 0$.

12. Find $grad\ \phi$ at (1,0,2) where $\phi = x^2y + 2xz^2 - 8$.

13. Find the values of a & b such that the function $f(z) = x^2 + ay^2 - 2xy + i(bx^2 - y^2 + 2xy)$ is analytic.

14. State Cauchy's integral formula.

15. Find the Laplace transform of $\sin 3t \sin 5t$.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Solve the equation $(1 + 2x)^2 y'' - 6(1 + 2x)y' + 16y = 8(1 + 2x)^2$. (8)

(ii) Solve the equation $(D^2 + 4D + 3)y = e^{-x} sinx$. (8)

Or

(b) (i) Solve $\frac{d^2y}{dx^2} + \frac{1}{x}\frac{dy}{dx} = \frac{12 \log x}{x^2}$. (8)

(ii) The number N of bacteria in a culture grew at a rate proportional to N. The value of N was initially 100 and increased to 332 in 1 hour. What was the value of N after 3/2 hours? (8)

17. (a) Verify Stoke's theorem for $\vec{F} = (2x - y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$ where S is the upper half surface of the sphere $(x^2 + y^2 + z^2) = 1$ and C is the circular boundary on Z = 0 plane. (16)

Or

(b) Verify Gauss divergence theorem for $\vec{F} = (x^2-yz)\vec{i} + (y^2-xz)\vec{j} + (z^2-xy)\vec{k}$ and S is the surface of the rectangular parallelepiped bounded by $x = 0, x = a, y = 0, y = b, z = 0$ and $z = c$. (16)

18. (a) Find the Bilinear transformation that maps z= ∞, I, 0 in to the points w= 0, -i, ∞ respectively. Also find its fixed Points. (16)

Or

(b) (i) Show that the function $u = \log\sqrt{x^2 + y^2}$ is harmonic and also find its conjugate. (8)

(ii) Obtain the bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = 0, 1, \infty$ respectively. (8)

19. (a) Evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$ by contour integration. (16)

Or

(b) (i) Show that the function $u = \log\sqrt{x^2 + y^2}$ is harmonic and also find its conjugate (8)

(ii) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)(x^2+4)}$ using contour integration. (8)

20. (a) (i) Find the Laplace Transform of the square-wave function of period 'a' given by

$$f(t) = \begin{cases} 1, & 0 < t < \frac{a}{2} \\ -1, & \frac{a}{2} < t < a \end{cases}$$

(8)

(ii) Using Convolution theorem evaluate $L^{-1}\left[\frac{1}{(s+1)(s+2)}\right]$. (8)

Or

(b) (i) Solve $y'' + 4y' + 4y = e^{-t}$, y(0)= 0 and $y'(0) = 0$ using Laplace transform. (8)

(ii) Compute $y(1,1)$ by using Runge-Kutta method of fourth order, given $\frac{dy}{dx} = y^2 + xy, y(1) = 1$. (8)