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Question Paper Code: 42002

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019.

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)

- The roots of $(D^2+2)y$ are
(a) ± 2 (b) $\pm 2i$ (c) $\pm i\sqrt{2}$ (d) $\sqrt{2}$
- The particular integral of $(4D^2 - 4D + 1)y = 4$ is
(a) -4 (b) 4 (c) -2 (d) -3
- The gradient of a scalar function is defined as
(a) ∇/ϕ (b) $\nabla * \phi$ (c) $\phi\nabla$ (d) $\nabla\phi$
- By stokes theorem, $\int_c \vec{r} \cdot d\vec{r} = \underline{\hspace{2cm}}$
(a) π (b) 1 (c) 0 (d) None of these
- 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 $\text{grad } \phi$ 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 $(D^2 + 4D + 3)y = e^{-x} \sin x$. (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 $z = \infty, 1, 0$ into the points $w = 0, -i, \infty$ 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

$$f(t) = \begin{cases} 1, & 0 < t < \frac{a}{2} \\ -1, & \frac{a}{2} < t < a \end{cases} \quad (8)$$

(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)