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Question Paper Code: 52002

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Second Semester

Civil Engineering

15UMA202- ENGINEERING MATHEMATICS-II

(Common to All branches)

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- How will You convert Cauchy's Homogeneous linear differential equation to a linear differential equation with constants Coefficients? CO1-R
(a) $z = \log x$ (b) $x = \log z$ (c) $z = e^x$ (d) $z = \cos x$
- How will You convert Legendre's linear differential equation to a linear differential equation with constants Coefficients? CO1-R
(a) $z = \log(ax+b)$ (b) $ax+b = \log z$ (c) $z = e^{(ax+b)}$ (d) $z = \cos(ax+b)$
- $\nabla(r^n) = ?$ CO2-R
(a) \vec{r} . (b) $r^{n-2}\vec{r}$. (c) $nr^{n-2}\vec{r}$. (d) nr^{n-2} .
- $\text{div}\left(\frac{\vec{r}}{r}\right) = ?$ CO2-R
(a) $\frac{1}{r}$ (b) $\frac{2}{r}$ (c) $\frac{r}{r}$ (d) $\frac{2}{r}r^n$
- $u = 3x^2y - y^3$ is CO3-R
(a) non - harmonic (b) harmonic (c) differentiable (d) non -differentiable
- The image of the line $x = 2$ under the transformation $w = \frac{1}{z}$ CO3-R
(a) 1/4 (b) 1/2 (c) 1/9 (d) 1/16

7. Find Value of $\int_C \frac{z}{z-2} dz$, where C is the circle $|z - 2| = \frac{3}{2}$ CO4-R
 (a) $2\pi i$ (b) $6\pi i$ (c) $4\pi i$ (d) $7\pi i$
8. The Poles of $f(z) = \frac{4}{z^3(z-2)}$ CO4-R
 (a) 1,2,0,3 (b) 2,0,0,0 (c) 4,0,0,0 (d) 3,0,0,0
9. The $L[e^{at}]$ is CO5-R
 (a) $1/s-a$ (b) $s/s-a$ (c) $a/s-a$ (d) $1/s+a$
10. The $L^{-1}[s/s^2+a^2]$ is CO5-R
 (a) $\cos at$ (b) $\sin at$ (c) $\sin at$ (d) $\cos at$

PART – B (5 x 2= 10Marks)

11. Transform $(x^2 D^2 + x D + 1) y = 0$ into differential equation with constant CO1-R
 coefficients, where $D = \frac{d}{dx}$.
12. If $\vec{F} = x^3 \vec{i} + y^3 \vec{j} + z^3 \vec{k}$, find $\text{div}(\text{curl} \vec{F})$. CO2-R
13. Show that the function $y + e^x \cos y$ is harmonic CO3-R
14. Evaluate $\int_C \frac{\cos \pi z^2}{(z-1)(z-2)} dz$ where C is $|Z| = 3/2$. CO4-R
15. Find the Laplace transform of $f(t) = \cos^3 3t$ CO5-R

PART – C (5 x 16= 80Marks)

16. (a) Solve $(D^2 + a^2) y = \tan x$ by the method of variation of parameters. CO1-App (16)
- Or
- (b) Solve $(2x - 1)^2 \frac{d^2 y}{dx^2} + (2x - 1) \frac{dy}{dx} - 2y = 8x^2 - 2x + 3$ CO1-App (16)
17. (a) Verify Green's theorem in the plane for CO2-App (16)
 $\int_C (3x^2 - 8y^2) dx + (4y - 6xy) dy$ where C is the boundary of the region defined by $x = y^2, y = x^2$.
- Or
- (b) Verify Stoke's theorem for the function $\vec{F} = x^2 \vec{i} + xy \vec{j}$ CO2-App (16)
 integrated round the square in the $z = 0$ plane whose sides are along the lines $x = 0, y = 0, x = a, y = a$.

18. (a) If $f(z) = u + iv$ is an analytic function of z and $CO3-Ana$ (16)
 $u - v = \frac{\cos x + \sin x - e^{-y}}{2(\cos x - \cosh y)}$, find $f(z)$ given that $f\left(\frac{\pi}{2}\right) = 0$.

Or

- (b) Find the bilinear transformation which maps the points $-2, 0, 2$ $CO3 Ana$ (16)
into the points $w = 0, i, -i$ respectively.

19. (a) Using Cauchy's integral formula, evaluate $\int_C \frac{1}{z^2 - 1} dz$ where C is $CO4-Ana$ (16)
the circle with centre at $Z=0$ and radius 2.

Or

- (b) Using contour integration, evaluate $\int_{-\infty}^{\infty} \frac{x dx}{(x+1)(x^2+1)}$ $CO4-Ana$ (16)

20. (a) Find the Laplace transform of $CO5-App$ (16)

- (i) $\sin 2t \sin 3t$
- (ii) $\cos^2 3t$
- (iii) $\sin^2 2t$

Or

- (b) Solve by using laplace transform $(D^2 + 9)y = \cos 2t$ given that $CO5-App$ (16)
 $y(0) = 1, y\left(\frac{\pi}{2}\right) = -1$.

