A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 52002

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

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)

1. The order of the differential equation CO1- R

$\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^4 + 8y = 0$ is

(a) 4 (b) 3 (c) 1 (d) 2

2. The particular integral of $(D^2+2)\, y = x^2$ CO1- R

(a) $\frac{x^2+1}{2}$ (b) $\frac{x^2}{2}$ (c) $\frac{x^2-1}{2}$ (d) $\frac{x}{2}$

3. A vector $\vec{F}$ is called solenoidal if CO2- R

(a) $\nabla \times \vec{F} \neq 0$ (b) $\nabla . \vec{F} \neq 0$ (c) $\nabla . \vec{F} = 0$ (d) $\nabla \times \vec{F} = 0$

4. If $\vec{F}$ represents the force acting on a particle moving along a curve C, then work done is CO2- R

(a) $\int_0^\infty \vec{F} \cdot d\vec{r}$ (b) $\int_C \vec{F} \cdot d\vec{F}$ (c) $\int_C \vec{F} \cdot d\vec{r}$ (d) None of these

5. The value of m such that $2x - x^2 + my^2$ is harmonic CO3- R

(a) m = 0 (b) m = 1 (c) m = -1 (d) m = 2

6. The necessary condition for the analyticity of a function is CO3- R

(a) $u_x = v_y$ & $u_y = -v_x$ (b) $u_x = v_x$ & $u_y = -v_y$

(c) $u_x = -v_y$ & $u_y = v_x$ (d) $u_x = v_y$ & $u_y = v_x$

7. The point z = a is called a removable singularity of f(z) if CO4- R

(a) $\lim_{z\to a} f(z)$ exists (b) $\lim_{z\to -a} f(z)$ exists (c) $\lim_{z\to 0} f(z)$ exists (d) None of these

8. The poles of tan z are CO4- R

(a) $z = n\frac{\pi}{2}$; n is odd (b) $z = \pm n\frac{\pi}{2}$; n is even

(c) $z = \pm n\frac{\pi}{2}$; n is odd (d) $z = n\frac{\pi}{2}$; n is even

9. $L[e^{at}] =$ CO5- R

(a) $\frac{1}{s+a}$ if $s + a > 0$ (b) $\frac{1}{s-a}$ if $s - a > 0$ (c) $\frac{a}{s-a}$ if $s - a > 0$ (d) $\frac{a}{s+a}$ if $s + a > 0$

10. The unit impulse function $\delta(t-a)$ is CO5- R

(a) $\lim_{h\to 0}\frac{1}{h},\ a \le t \le a+h$ (b) $\lim_{h\to 0}\frac{1}{h},\ a \le t < a+h$

(c) $\lim_{h\to 0}\frac{1}{h},\ a < t \le a+h$ (d) $\lim_{h\to 0}\frac{1}{h},\ a < t < a+h$

PART – B (5 x 2= 10 Marks)

11. Transform CO1- R

$(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 0$ into differential equation with constant coefficient.

12. Find the value of λ , if CO2- R

$\vec{F} = (\lambda xy - z^3)\vec{i} + (\lambda - 2)x^2\vec{j} + (1-\lambda)xz^2\vec{k}$ is irrotational.

13. State Cauchy-Riemann equations in Cartesian coordinates. CO3- R

14. Evaluate CO4- R

$\int_C \frac{dz}{z+4}$ where C is the circle $|z| = 2$.

15. Find $L[\cos at]$. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) (i) Solve $(D^2 - 4D - 5)y = e^{2x} + 3\cos 4x$. CO1- App (8)

(ii) Solve $[(1+x)^2D^2 + (1+x)D + 1]y = \cos 2\log(1+x)$. CO1- App (8)

Or

(b) (i) Solve $(D^2 – 4D + 4)y = e^{2x}$ by the method of variation of parameters. CO1- App (8)

(ii) Solve $(x^2 D^2 – 7xD + 12)y = x^2$. CO1- App (8)

17. (a) Verify Green's theorem for CO2- E (16)

$\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the region bounded by the lines $x = 0, y = 0, x + y = 1$.

Or

(b) Verify Gauss divergence theorem for CO2- E (16)

$\vec{F} = xz\vec{i} + 4xy\vec{j} - z^2\vec{k}$ over the cube bounded by $x = 0, x = 2, y = 0, y = 2, z = 0$ and $z = 2$.

18. (a) (i) Determine the analytic function $f(z) = u+iv$ if $v = e^{2x}(y\cos 2y + x\sin 2y)$. CO3- Ana (8)

(ii) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into $w = 0, i, \infty$ respectively. CO3- Ana (8)

Or

(b) Prove that the function $v = e^{-x}(x\cos y + y\sin y)$ is harmonic and determine the corresponding analytic function f(z). CO3- Ana (16)

19. (a) (i) Using Cauchy's integral formula evaluate CO4- Ana (8)

$\int_C \frac{2}{(z-1)(z+3)}dz$ where C is the circle $|z - 1| = 2$.

(ii) Expand CO4- Ana (8)

$f(z) = \frac{z^2 - 1}{(z+2)(z+3)}$ as a Laurent series valid in the region (i) $|z| < 2$ (ii) $|z| > 3$.

Or

(b) Evaluate CO4- E (16)

$\int_{-\infty}^{\infty} \frac{x^2}{(x^2+a^2)(x^2+b^2)} dx$, a > 0, b > 0 by using Contour integration.

20. (a) (i) Find the Laplace transform of CO5- App (8)

$f(t) = \begin{cases} k, & 0 \le t \le a \\ -k, & a \le t \le 2a \end{cases}$;

$f(t + 2a) = f(t)\ \forall t$.

(ii) Find CO5- App (8)

$L^{-1}\left[\frac{1}{(s+1)(s+3)}\right]$ using partial fraction method.

Or

(b) (i) Find CO5- App (8)

$L\left[\frac{\cos 2t - \cos 3t}{t}\right]$.

(ii) Solve by using Laplace transform technique, CO5- App (8)

$y'' + 5y' + 6y = 2$ given that $y(0) = 0$ and $y'(0) = 0$.