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

Question Paper Code: 52002

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

Second Semester

Civil Engineering

01UMA202 - ENGINEERING MATHEMATICS - II

(Common to all branches)

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Find the particular integral of $(D^2 + 4)y = \pi$.
2. Transform $[(2x+3)^2 D^2 -2(2x+3)D -12] y = 0$ into an ordinary differential equation.
3. State Green's theorem.
4. Find 'a' such that $\vec{F} = (x+3y)\vec{i} + (y-2z)\vec{j} + (x+az)\vec{k}$ is solenoidal.
5. Test the analyticity of the function $f(z) = \bar{z}$.
6. Prove that an analytic function with constant real part is constant.
7. State Cauchy's integral formula for first derivative of an analytic function.
8. Expand $\frac{1}{z-2}$ at $z = 1$ in a Taylor's series.
9. Find the Laplace transform of 2^t.
10. Find the inverse Laplace transform of $\frac{1}{s(s+3)}$

.PART - B (5 x 16 = 80 Marks)

11. (a) (i) Solve $(D^2 - 4D + 3)y = sin3x\, cos2x$. (8)

(ii) Solve $(x^2D^2 + 3xD + 1)y = cos(log\, x)$. (8)

Or

(b) (i) Solve $(D^2+2D+5)\, y = e^{-x} \tan x$ by method of variation of parameter. (8)

(ii) Solve $\frac{dx}{dt} + y = \sin t$ and $\frac{dy}{dt} + x = \cos t$ given x = 2, y =0 when t = 0. (8)

12. (a) Verify Gauss divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\,\vec{j} + yz\vec{k}$ taken over the cube bounded by the planes $x = 0, x =1, y = 0, y =1, z = 0, z =1$. (16)

Or

(b) Verify Stoke ' s theorem for $\overline{F} = y\vec{i} + z\vec{j} + x\vec{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary. (16)

13. (a) (i) Find the bilinear mapping which maps the points $Z = 0, -1, 1$ of the Z-plane onto $W = i, 0, \infty$ of the W-plane. (8)

(ii) Construct the analytic function $f(z) = u + iv$ given that $2u - 3v = e^x(cosy + sin\, y)$ (8)

Or

(b) (i) If $f(z) = u + iv$ an analytic function and $u - v = e^x (\cos y - \sin y)$ find $f(z)$ interms of z. (8)

(ii) Find the image of $| z - 2i | = 2$, under the transformation $w = 1/z$. (8)

14. (a) Find the value of $\int_0^{\pi} \frac{1 + 2\cos\theta}{5 + 4\cos\theta}\, d\theta$ using contour integration. (16)

Or

(b) (i) Find Laurent's series expansion of $f(z) = \frac{7z - 2}{z(z - 2)(z + 1)}$ valid $1< |z+1|<3$ (8)

. (ii) Evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$. (8)

15. (a) (i) Find the Laplace transform of a periodic function

$f(t) = \begin{cases} t & 0 < t < 1 \\ 2 - t & 1 < t < 2 \end{cases}$ and $f(t) = f(t+2)$. (8)

(ii) Using Laplace transform, solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{3t}$, given $y = 2$ and $\frac{dy}{dx} = 3$ when $t = 0$. (8)

Or

(b) (i) Find the Laplace transform of the Half-wave rectifier function

$$f(t) = \begin{cases} \sin \omega t, & 0 < t < \frac{\pi}{\omega} \\ 0, & \frac{\pi}{\omega} < t < \frac{2\pi}{\omega} \end{cases}$$, with $f\left(t + \frac{2\pi}{\omega}\right) = f(t)$. (8)

(ii) Solve the initial value problem $y'' - 3y' + 2y = 4t,\ y(0) = 1,\ y'(0) = -1$. (8)