Reg. No.												

Question Paper Code	11731

B.E/B.Tech - DEGREE EXAMINATIONS, NOV/DEC 2022

Second Semester

Civil Engineering

(Common to all branches)

20BSMA201 - ENGINEERING MATHEMATICS - II

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

Marks, K-Level,CO

1. Find the directional derivative of the function $\phi = x^3yz$ at the point (1, 4, 1). *2,K2,CO1*

2. Prove that $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ is irrotational. *2,K1,CO1*

3. Reduce the equation $(x^2D^2 - xD + 4)\, y = x^2 \sin(\log x)$ into an ordinary differential equation with constant coefficients. *2,K1,CO2*

4. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 0$. *2,K3,CO2*

5. Show that an analytic function with constant imaginary part is constant. *2,K1,CO3*

6. Find the fixed points of the transformation $w = \frac{6z-9}{z}$. *2,K2,CO3*

7. Discuss the nature of singularities of $\frac{\sin z - z}{z^3}$. *2,K1CO4*

8. Find the Taylor's series for f(z)=sinz about $z = \frac{\pi}{4}$. *2,K2,CO4*

9. If L[f(t)]=F(s), then prove that $L[f(e^{at}f(t))] = F(s-a)$. *2,K1,CO5*

10. Find $L(\cos^2 2t)$. *2,K2,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) Verify Gauss Divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x=0,\ x=1,\ y=0,\ y=1,\ z=0,\ z=1$. *16,K3,CO1*

OR

b) (i) Find a and b so that the surfaces $ax^3 - by^2z - (a+3)x^2 = 0$ and $4x^2y - z^3 - 11 = 0$ cut orthogonally at the point $(2,-1,-3)$. *8,K2,CO1*

(ii) Verify Green's theorem in a plane for $\int_C [(3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by the lines $x = 0$, $y = 0$ and $x + y = 1$. 8,K2,CO1

12. a) (i) Solve $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[\log(1+x)]$. 8,K3,CO2

(ii) Solve $(x^2D^2 - xD + 1)y = x \log x$. 8,K3,CO2

OR

b) (i) Solve $(D^2 + a^2)y = \tan ax$, by using method of variation of parameters. 8,K3,CO2

(ii) Solve $x^2 \frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 4y = x^2 + \frac{1}{x^2}$. 8,K3,CO2

13. a) (i) If $f(z)$ is an analytic function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$. 8,K2,CO3

(ii) Determine the analytic function $w = u + iv$ if $u = e^{2x}(x\cos 2y - y\sin 2y)$. 8,K3,CO3

OR

b) (i) Find the image in the w – plane of the infinite strip $\frac{1}{4} \le y \le \frac{1}{2}$ under the transformation $w = \frac{1}{z}$ 8,K2,CO3

(ii) Find the bilinear map which maps the points $z = 0, -1, i$ into $w = i, 0, \infty$. Also find the image of the unit circle of the z – plane. 8,K2,CO3

14. a) (i) Using Cauchy's integral formula, evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)}dz$ where C is $|z| = 3$. 8,K3,CO4

(ii) Find the Laurent's series function $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ in the interval $1 < |z+1| < 3$. 8,K2,CO4

OR

b) (i) Evaluate by using Cauchy's residue theorem $\int_C \frac{z+1}{(z-3)(z-1)}dz$ where C is the circle $|z| = 2$. 8,K3,CO4

(ii) Evaluate $\int_{0}^{2\pi} \frac{d\theta}{2+\cos\theta}$ using contour integration. 8,K3,CO4

15. a)

(i) Find the Laplace transform of $f(t) = \begin{cases} t & for\ 0 < t < a \\ 2a - t, & for\ a < t < 2a \end{cases}$ and $f(t+2a) = f(t)$. 8,K2,CO5

(ii) Find$L[t^2 e^{-3t} \sin 2t]$. 8,K2,CO5

OR

b)

(i) Using Laplace transform, solve $\frac{d^2y}{dt^2} + 4y = \sin 2t$ given $y(0) = 3$, $y'(0) = 4$. 8,K3,CO5

(ii) Find $L^{-1}\left[\frac{s^2}{(s^2+4)^2}\right]$, using convolution theorem. 8,K2,CO5