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**Question Paper Code : 24331**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2018

Second Semester

Civil Engineering

MA2161 – MATHEMATICS-II

(Common to all Branches)

(Regulations 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL Questions

Part A – (10 x 2 = 20 marks)

1. Solve  $(D^4 + 4)y = 0$ .
2. Reduce  $((5 + 2x)^2 D^2 - 6(5 + 2x)D + 8)y = 0$  to a differential equation with constant coefficients.
3. Check whether  $\vec{v} = (y + z)\hat{i} + (z + x)\hat{j} + (x + y)\hat{k}$  is solenoidal.
4. Evaluate  $\iiint_S \vec{r} \cdot \hat{n} dS$  where S is any closed surface of volume V.
5. Check whether  $f(z) = z\bar{z}$  is analytic at  $z=0$ .
6. Find the fixed points of the transformation  $w = \frac{6iz + 9}{z}$ .
7. Find the Taylor's series of  $f(z) = e^z$  about  $z = 0$ .
8. Find the nature of the singularity of  $\sin\left(\frac{1}{z-a}\right)$ .
9. Find  $L(e^{at} \sin bt)$ .
10. State the initial value theorem for Laplace transforms.

Part B – (5 x 16 = 80 marks)

11. a. (i) Solve:  $(D^4 - 1)y = \cos x \cosh x$ . (8)
- (ii) Solve:  $(x^2 D^2 - 4xD + 6)y = (\log x)^2$ . (8)

(OR)

- b. (i) Solve by the method of variation of parameters:  $(D^2 + 7D - 8)y = e^{2x}$ . (8)

(ii) Solve :  $\frac{dx}{dt} - y = t$ ;  $\frac{dy}{dt} + x = t^2$ . (8)

12. a. (i) Verify Green's theorem for  $\oint_C e^{-x} \sin y dx + e^{-x} \cos y dy$  where C is the rectangle with vertices  $(0,0)$ ,  $(\pi,0)$ ,  $(\pi, \frac{\pi}{2})$  &  $(0, \frac{\pi}{2})$ . (10)

(ii) Show that  $\frac{\vec{F}}{r^3}$  is irrotational and find its scalar potential. (6)

(OR)

b. Verify Stoke's theorem for  $\vec{F} = (y-z)\hat{i} + yz\hat{j} - xz\hat{k}$  where S is the surface bounded by the planes  $x=0$ ,  $x=1$ ,  $y=0$ ,  $y=1$ ,  $z=0$  &  $z=1$  above the  $xy$ -plane. (16)

13. a. (i) Construct the analytic function whose imaginary part is  $e^{-x}(x \cos y + y \sin y)$ . (8)

(ii) Find the image of the half-plane  $x > c_1$  under the transformation  $w = \frac{1}{z}$  where  $c_1 > 0$ . Also sketch the regions in the  $z$ -plane and the  $w$ -plane. (8)

(OR)

b. (i) Find the bilinear transformation which maps  $0, 1, \infty$  onto  $i, -1, -i$  respectively. (8)

(ii) If  $f(z)$  is analytic, then show that  $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ . (8)

14. a. (i) Using contour integration, evaluate  $\int_0^{2\pi} \frac{d\theta}{2 + \cos \theta}$ . (10)

(ii) Using Cauchy integral formula for derivatives, evaluate  $\oint_C \frac{e^{2z}}{(z+1)^4} dz$  where C is the circle  $|z|=2$ . (6)

(OR)

b. (i) Using Cauchy residue theorem, evaluate  $\oint_C \frac{z \sec z}{(1-z^2)} dz$  where C is the ellipse  $4x^2 + 9y^2 = 9$ . (8)

(ii) Obtain the Laurent's series for  $f(z) = \frac{1}{(z+2)(1+z^2)}$  in the regions :  $1 < |z| < 2$  and  $|z| > 2$ . (8)

15. a. (i) Using Laplace transforms, solve  $(D^2 + 2D + 2)y = 5 \sin t$ ,  $y(0) = y'(0) = 0$ . (10)

(ii) Find  $L\{\sin t\}$ . (6)

(OR)

b. (i) Find  $L\left(\frac{\cos 4t \sin 2t}{t}\right)$ . (8)

(ii) Use convolution theorem to find  $L^{-1}\left\{\frac{1}{s(s+1)(s+2)}\right\}$ . (8)

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