Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

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 $\bar{\mathbf{v}} = (y+z)\hat{\mathbf{i}} + (z+x)\hat{\mathbf{j}} + (x+y)\hat{\mathbf{k}}$ is solenoidal.
4. Evaluate $\iint_S \bar{\mathbf{r}} \cdot \hat{\mathbf{n}} dS$ 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: $(x^2D^2 - 4xD + 6)y = (\log x)^2$. (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 $(0,0)$, $(\pi,0)$, $\left(\pi, \frac{\pi}{2}\right)$ & $\left(0, \frac{\pi}{2}\right)$. (10)

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

(OR)

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