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Question Paper Code : 52763

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Second Semester
Civil Engineering
MA 2161 – MATHEMATICS – II
(Common to all Branches)
(Regulations 2008)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Solve : $(D^2 + 4D + 13)\, y = 0$.

2. Eliminate y from $\frac{dx}{dt} - y = t$, $x + \frac{dy}{dt} = \sin t$.

3. Find the unit normal vector to the surface $x^2y + 2xz^2 = 8$ at the point (1, 0, 2).

4. State Green's Theorem.

5. Prove that $u = (x-1)^3 - 3xy^2 + 3y^2$ is harmonic.

6. Determine the critical points of $w = z^3 - 3z^2 - 9z + 8$.

7. Evaluate : $\int_c \frac{z^3 - 3}{z - 2} dz$, $C: |z| = 1$.

8. Name the four types of Singularities.

9. Find the Laplace Transform of unit step function.

10. Obtain the inverse Laplace Transform of $\frac{1}{(s+4)^5}$.

PART – B (5×16=80 Marks)

11. a) i) Solve $(D^2 + 5D + 6)\, y = e^{2x}.\sin 3x$. (8)

ii) By the method of variation of parameters, solve $(D^2 + a^2)\, y = \tan ax$. (8)

(OR)

b) i) Solve $(D^2 + 6D + 8)\, y = e^{-x}.x^2$. (8)

ii) Solve $x^2y'' - 3xy' - 5y = \cos(\log x)$. (8)

12. a) i) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. (8)

ii) Prove that $\bar{F} = \left(3x^2 + 2y^2 + 1\right)\bar{i} + \left(4xy - 3y^2z - 3\right)\bar{j} + \left(2 - y^3\right)\bar{k}$ is ir-rotaional and hence find the scalar function. (8)

(OR)

b) Verify Gauss-Divergence theorem for $\bar{F} = \left(x^2 - yz\right)\bar{i} + \left(y^2 - zx\right)\bar{j} + \left(z^2 - xy\right)\bar{k}$ over the surface S bounded by $0 \le x \le a,\ 0 \le y \le b,\ 0 \le z \le c$. (16)

13. a) i) State and prove the orthogonal property of analytic function. (8)

ii) Find the Bilinear transformation that maps the points $z = -1, i, 1$ onto $w = 1, i, -1$. (8)

(OR)

b) i) Construct the analytic function $f(z) = u + iv$, if $u = e^x(x.\cos y - y.\sin y)$. (8)

ii) Find the image of the circle $|z - 3i| = 3$ under the transformation $w = \frac{1}{z}$. (8)

14 a) i) By Cauchy's Integral formula, evaluate : $\int_c \frac{z+4}{z^2+2z+5}dz$, $C: |z+1-i| = 2$. (8)

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

(OR)

b) Using Contour integration, evaluate : (8+8)

i) $\int_0^\infty \frac{dx}{(x^2+1)^2}$ and .

ii) $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$

15. a) i) Find $L\left(\frac{1-\cos t}{t}\right)$ and $L^{-1}\left[\tan^{-1}(s)\right]$. (4+4)

ii) By Convolution Theorem, find $L^{-1}\left[\frac{s^2}{(s^2+a^2).(s^2+b^2)}\right]$. (8)

(OR)

b) i) Find the Laplace Transform of $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$

where $f(t + a) = f(t)$. (8)

ii) Using Laplace Transform, solve $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4$, $y(0) = 2$, $y'(0) = 3$. (8)

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