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END SEMESTER EXAMINATIONS – MAY 2011
B.E./B.Tech- Second Semester– (Regulation 2008)

27

MA 9161 MATHEMATICS-II

Time: 3 hours

Answer All Questions

Max Marks: 100

Part A (10x2=20)

1. Find the particular integral of $(D^2 + 3D + 2)y = 5$.
2. Solve $\frac{d^3x}{dt^3} - 3\frac{d^2x}{dt^2} + 3\frac{dx}{dt} - x = 0$.
3. Find the normal vector to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$.
4. Find 'a' if $\vec{F} = (axy - z^3)\vec{i} + (a - 2)x^2\vec{j} + (1 - a)xz^2\vec{k}$ is an irrotational vector.
5. Check for analyticity at any point for the function $f(z) = |z|^2$.
6. If $z = i$ is the fixed point of the bilinear transformation $w = \frac{1}{z + c}$ then find 'c'.
7. State Cauchy's integral formula.
8. Find the residue of $ze^{1/z}$ at its singular point.
9. Find $L[t \sin 2t]$.
10. If $f(t) = e^{-2t} \sin 2t$, find $L[f'(t)]$.

Part B (5X16=80)

11 (i) Solve $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$ by using method of variation of parameters. (8)

(ii) Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x$. (8)

12(a) (i) If $\nabla\phi = 2xyz^3\vec{i} + x^2z^3\vec{j} + 3x^2yz^2\vec{k}$, find $\phi(x, y, z)$ such that $\phi(1, -2, 2) = 4$. (8)

(ii) Using Green's theorem evaluate $\int_C (xy + x^2)dx + (x^2 + y^2)dy$, where C is the square formed by the lines $x = \pm 1, y = \pm 1$. (8)

{OR}

12(b) Verify Gauss Divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube

$x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.

(16)

[P.T.O]

13. (a) (i) An electrostatic field in the xy -plane is given by the potential function $\phi = 3x^2y - y^3$, find the stream function. (8)

(ii) Discuss the transformation $w = \frac{1}{z}$, and hence find the image of $|z - 2i| = 2$ under the same transformation. (8)

[OR]

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

(ii) Find the analytic function whose imaginary part is $e^x(x \cos y - y \sin y)$. (8)

14. (a) (i) Evaluate $\int_C \frac{z+4}{z^2+2z+5} dz$, where C is the circle $|z+1-i|=2$. (8)

(ii) Expand $f(z) = \frac{z^2-1}{(z+2)(z+3)}$ in a Laurent's series of $2 < |z| < 3$. (8)

[OR]

14. (b) (i) Obtain the Taylor's series expansion of $\log(1+z)$ when $|z| < 1$. (4)

(ii) By integrating around a unit circle, evaluate $\int_0^{2\pi} \frac{d\theta}{13+5\cos\theta}$. (12)

15. (a) (i) Evaluate $\int_0^{\infty} te^{-3t} \sin t dt$. (6)

(ii) Find the Laplace transform of the square-wave function of period a defined

$$\text{as } f(t) = \begin{cases} 1 & \text{when } 0 < t < \frac{a}{2} \\ -1 & \text{when } \frac{a}{2} < t < a. \end{cases} \quad \text{and } f(t+a) = f(t) \quad (10)$$

[OR]

15. (b) (i) Find $L^{-1} \left[\frac{1}{s(s^2+1)} \right]$ using convolution theorem. (6)

(ii) Solve using Laplace transformation,

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = \sin t; \quad y(0) = 2, y'(0) = 0 \quad (10)$$

---End---