**Reg. No. :** | | | | | | | | | | |

## Question Paper Code: 51022

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Second Semester

Civil Engineering

15UMA202 – ENGINEERING MATHEMATICS-II

(Common to ALL Branches)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The Particular solution of $(D^2 + 3D + 2)y = 5cosx$ is

   (a) $0.5cosx + 1.5sinx$ (b) $x1.5cosx + 0.5\ sinx$

   (c) $1.5\ sinx$ (d) $0.5cosx$

2. The corresponding equation with constant coefficients of the equation $((2 + 3x)^2D^2 + 5(2 + 3x)D - 3)y = 0$ is

   (a) $(9\theta^2 - 9\theta - 3)y = 0$ (b) $(9\theta^2 + 6\theta - 3)y = 0$

   (c) $(9\theta^2 - 24\theta - 3)y = 0$ (d) $(\theta^2 - 9\theta - 3)y = 0$

3. If $\phi = log(x^2 + y^2 + z^2)$, then $\nabla\phi =$

   (a) 0 (b) $\vec{r}$ (c) $r\vec{r}$ (d) $\frac{2\vec{r}}{r^2}$

4. If $\vec{F} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + \lambda z)\vec{k}$ is solenoidal, then the value of $\lambda$ is

   (a) 2 (b) -2 (c) 3 (d) 0

5. Let $f(z) = e^z$. Then the harmonic conjugate of $e^x cosy$ is

(a) $e^x cosy$ (b) $e^x siny$ (c) $-e^x cosy$ (d) $-e^x siny$

6. The fixed points of $w = \frac{2zi+5}{z-4i}$ are

(a) 5i, i (b) -5i, -i (c) 5i, -i (d) -5i, i

7. The value of $\int_c e^{1/z}\, dz$, where $c$ is $|z| = 1$ is

(a) $2\pi i$ (b) $\infty$ (c) 0 (d) $\frac{1}{2\pi i}$

8. The Residue of $f(z) = \frac{z}{(z-1)^2}$ at its pole is

(a) 0 (b) 1 (c) -2 (d) 1/2

9. The Laplace transform of $e^{-t} sint$ is

(a) $\frac{s+1}{(s+1)^2+1}$ (b) $\frac{1}{s^2+1}$ (c) $\frac{s}{s^2+1}$ (d) $\frac{1}{(s+1)^2+1}$

10. $L^{-1}\left[\frac{1}{s(s+1)}\right] =$

(a) $1 + e^t$ (b) $\frac{1+e^t}{t}$ (c) $\frac{1-e^t}{t}$ (d) $1 - e^{-t}$

PART - B (5 x 2 = 10 Marks)

11. Solve $(D^2 + D + 1)y = 0$.

12. Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$ and hence show that $\nabla^2\left(\frac{1}{r}\right) = 0$.

13. State any two properties of analytic function.

14. Expand $sinz$ in a Taylor's series about $z = \frac{\pi}{4}$.

15. Find $L^{-1}\left[log\left(\frac{s^2-a^2}{s^2+b^2}\right)\right]$.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Solve $(D^2 + 4D + 3)y = e^{2x}cos2x - sin3x$. (8)

(ii) Radium decomposes at a rate proportional to the quantity of radium present. Suppose that it is found that in 25 years approximately 1.1% of certain quantity of radium has decomposed. Determine approximately how long will it take for one-half of the original amount of radium to decompose. (8)

Or

(b) (i) Solve $\frac{d^2y}{dx^2} + 4y = 4tan2x$ using method of variation of parameters. (8)

(ii) Solve $(x^2D^2 - xD + 1)y = \left(\frac{logx}{x}\right)^2$. (8)

17. (a) (i) Verify Green's theorem in the plane for $\int_c (3x^2 - 8y^2)\, dx + (4y - 6xy)dy$, where c is the boundary of the region bounded by $x = y^2$ and $y = x^2$. (8)

(ii) Verify Stoke's theorem for $\vec{F} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - xz\vec{k}$, where $s$ is the surface of the cube $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$ above the xy-plane. (8)

Or

(b) Verify Gauss's divergence theorem for $\vec{F} = (x^2 - yz)\vec{i} - (y^2 - zx)\vec{j} + (z^2 - xy)\vec{k}$ taken over rectangular parallelepiped $0 \leq x \leq a,\ 0 \leq y \leq b, 0 \leq z \leq c$. (16)

18. (a) (i) Find v such that f(z) = u + iv is analytic, given $u = e^{-(x^2-y^2)}cos2xy$. (8)

(ii) Determine the bilinear transformation that maps the points -1, 0, 1 in the z- plane onto the points 0, i, 3i in the w-plane. (8)

Or

(b) (i) If f(z) = u + iv is an analytic function of z, then show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^p = p^2\ |f(z)|^{p-2}\ |f'(z)|^2$. (8)

(ii) Find the image of the circle $|z - 2i| = 2$ under the transformation w = 1/z. (8)

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

(ii) Evaluate $\int_0^\infty \frac{xsinmx}{x^2+a^2}\, dx, m > 0, a > 0$. (8)

Or

(b) (i) Evaluate $\int_0^{2\pi} \frac{d\theta}{13+5sin\theta}$ by contour integration. (8)

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

20. (a) (i) Find (1) $L[t^2 e^t sint]$ (2) $L\left[\frac{sin^2 t}{t}\right]$. (8)

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

Or

(b) (i) Find the Laplace Transform of $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$ and *f(t+2a) = f(t).* (8)

(ii) Solve $y'' - 3y' + 2y = e^{2t}$, given that $y(0) = -3, y'(0) = 5$. (8)

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