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

Question Paper Code: 41202

B.E. / B.Tech. DEGREE EXAMINATION, NOVEMBER 2015

Second Semester

Civil Engineering

14UMA202 - ENGINEERING MATHEMATICS – II

(Common to ALL branches)

(Regulation 2014)

Duration: Three hours — Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The *P.I.* of $(D^2+4)y=\cos 2x$ is

   (a) $\frac{-x\sin 2x}{4}$ (b) $\frac{x\sin 2x}{4}$ (c) $\frac{-x\cos 2x}{4}$ (d) $\frac{x\cos 2x}{4}$

2. The complimentary function of $(D^2-2D)y=3e^x\sin x$ is

   (a) $(A+Bx)e^{2x}$ (b) $(Ax+B)e^{-2x}$ (c) $A+Be^{2x}$ (d) Ae^x+Be^{2x}

3. The unit vector normal to the surface $x^2+y^2-z=10$ at (1, 1, 1) is

   (a) $\frac{2\vec{i}+2\vec{j}-\vec{k}}{3}$ (b) $\frac{2\vec{i}-2\vec{j}-\vec{k}}{3}$ (c) $\frac{-2\vec{i}+2\vec{j}+\vec{k}}{3}$ (d) $\frac{2\vec{i}+2\vec{j}+\vec{k}}{3}$

4. By stokes theorem, $\int_c \vec{r}\,\overrightarrow{dr}=$ _______ .

   (a) π (b) 1 (c) 0 (d) None of these

5. The fixed points of $\omega=\frac{3z-4}{z-1}$ is

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

6. The bilinear transformation that maps the points $\infty, i, 0$ onto $0, i, \infty$ is

(a) $-\frac{1}{z}$ (b) $-\frac{i}{z}$ (c) $\frac{i}{z}$ (d) None of these

7. The value of $\int_C \frac{z}{z+2}dz$ if C is $|z|=1$

(a) $4\pi i$ (b) $-4\pi i$ (c) $2\pi i$ (d) 0

8. The nature of the singular point of $f(z)=\frac{1}{\sin\frac{1}{z-a}}$ is

(a) Isolated singularity (b) Essential singularity
(c) Removable singularity (d) None of the above

9. $L\left[\frac{1}{\sqrt{t}}\right]=$

(a) $\sqrt{\frac{\pi}{s}}$ (b) $\frac{\sqrt{\pi}}{s}$ (c) $-\sqrt{\frac{\pi}{s}}$ (d) $\frac{\pi}{\sqrt{s}}$

10. $L\left[\frac{\cos at}{t}\right]=$

(a) $\frac{1}{s}$ (b) 0 (c) $\frac{-1}{s^2}$ (d) None of these

PART - B (5 x 2 = 10 Marks)

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

12. Prove that $\text{div}\left(\text{curl}\,\vec{F}\right)=0$.

13. Define bilinear transformation.

14. State Cauchy's integral formula.

15. Find the laplace transform of $\sin 3t \sin 5t$.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Solve $(D^2+1)y=\sin x \sin 2x$. (8)

(ii) Solve $(x^2D^2-7xD+12)y=x^2$. (8)

Or

(b) (i) Solve $(D^2 + a^2)y = \tan ax$ by method of variation of parameters. (8)

(ii) The number of bacteria in a culture grows at a rate proportional to the number present. If the number doubles in one hour, find how much it will be in 4 hours? Also find the time at which the number will be 4 times the original number. (8)

17. (a) (i) Prove $\vec{F} = (y^2 \cos x + z^3)\vec{i} + (2y \sin x - 4)\vec{j} + 3xz^2 \vec{k}$ is irrotational and find its scalar potential. (8)

(ii) 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 defined by $x = y^2, y = x^2$. (8)

Or

(b) Verify the Gauss Divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. (16)

18. (a) (i) If $w = u(x, y) + iv(x, y)$ is an analytic function the curves of the family $u(x, y) = a$ and the curves of the family $v(x, y) = b$ are cut orthogonally, where a and b are the constants. (8)

(ii) Find the image of $|z - 2i| = 2$ under the transformation $w = \frac{1}{z}$. (8)

Or

(b) (i) Find the regular function whose imaginary part is $e^{-x}(x \cos y + y \sin y)$. (8)

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

19. (a) (i) Using Cauchy's integral formula, evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$, c is the circle $|z| = 3$ (6)

(ii) Using contour integration, prove that $\int_0^{2\pi} \frac{\cos 3\theta}{5 - 4\cos\theta} d\theta = \frac{\pi}{12}$. (10)

Or

(b) (i) Find the Laurent's expansion of $f(z) = \frac{7z - 2}{z(z-2)(z+1)}$ valid in the region $1 < |z+1| < 3$ (8)

(ii) Using contour integration, evaluate $\int_{-\infty}^{\infty} \frac{x\,dx}{(x+1)(x^2+1)}$. (8)

20. (a) Given $y' = x^2 + y$, $y(0) = 1$, find y (0.1) by Taylor series method, y (0.2) by modified Euler's method, y (0.3) by R-K method. (16)

Or

(b) (i) Find the Laplace transform of the function $f(t) = \begin{cases} \sin t, & 0 < t < \pi \\ 0, & \pi < t < 2\pi \end{cases}$ (8)

(ii) Using Laplace transform, solve $y'' + 6y' + 9y = 2e^{-3t}$, $y(0) = 1$, $y'(0) = -2$. (8)