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

Question Paper Code: 41022

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

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 Particular integral for $(D^2 + 4)y = sin2x$ is

   (a) $\frac{sin2x}{8}$ (b) $\frac{-xcos2x}{8}$ (c) $\frac{-xsinx}{8}$ (d) $\frac{-cos2x}{8}$

2. The solution of $(x^2D^2 - xD + 1)y = 0$ is

   (a) $y = (Alogx + B)x$ (b) $y = (Ax + B)logx$
   (c) $y = (Az + B)logz$ (d) $y = Ax^2 + Bx$

3. The directional derivative of *f* = *xyz at* (1, 1, 1) in the direction of $\vec{i} + \vec{j} + \vec{k}$.

   (a) 3 (b) $3\sqrt{3}$ (c) $\frac{6}{4}$ (d) $\sqrt{3}$

4. If $\vec{f} = xy\vec{i} + yz\vec{j} + zx\vec{k}$, then *div* $(curl\overrightarrow{f})$ is

   (a) -2 (b) 3 (c) 0 (d) 1

5. The function $w = \bar{z}$ is

   (a) not analytic (b) analytic only at $x = 0$
   (c) analytic everywhere (d) analytic only at $y = 0$

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

(a) $z = 2, -1$ (b) $z = -1 \pm 2i$

(c) $z = 0{,}1$ (d) $z = 2 \pm 3i$

7. The value of $\int_c \frac{3z^2 + 7z + 1}{z+1} dz$, where c is the circle $|z| = \frac{1}{2}$ is

(a) 11 (b) -3 (c) 3 (d) 0

8. The residue of $f(z) = \frac{z}{z^2+1}$ about $z = i$ is

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

9. The value of $L[t^3]$ is

(a) $\frac{3}{s^3}$ (b) $\frac{6}{s^3}$ (c) $\frac{6}{s^4}$ (d) $\frac{3}{s^4}$

10. $L^{-1}\left[\frac{s-3}{(s-3)^2+4}\right] =$

(a) $e^{3t} sint$ (b) $e^{3t} cos2t$

(c) $e^{-3t} sint$ (d) $e^{-3t} cost$

PART - B (5 x 2 = 10 Marks)

11. Convert the equation $(2x+5)^2 y'' - 6(2x+5)y' + 8y = 6x$ into a differential equation with constant coefficients.

12. Find 'a' such that the vector $\vec{F} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + az)\vec{k}$ is solenoidal.

13. Examine whether $\frac{1}{2} log(x^2 + y^2)$ is harmonic.

14. Find the Taylor's series for $sinz$ about $z = \frac{\pi}{4}$.

15. Apply Euler's method to determine the value of $y(0.2)$ from the equation $y' = x + y, y(0) = 1$.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Solve $(D^2 + 3D + 2)y = x^2 + 4sinx$. (8)

(ii) Find the general solution of $x^2 \frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + y = \frac{sin(logx)}{x}$. (8)

Or

(b) (i) Solve $(D^2 + 4)y = 4tan2x$, using the method of variation of parameters. (8)

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

17. (a) (i) Show that $\vec{F} = (y^2 cosx + z^3)\vec{i} + (2y\, sinx - 4)\vec{j} + (3xz^2)\vec{k}$ is irrotational and find its Scalar potential. (8)

(ii) Examine whether Green's theorem is true in a plane for $\int_c (3x^2 - 8y^2)\, dx + (4y - 6xy)dy$, where c is the boundary of the region bounded by the lines $x = 0$, $y = 0$, $x + y = 1$. (8)

Or

(b) Verify Gauss's divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$, where S is the closed surface of the cube formed by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$ and $z = 1$. (16)

18. (a) (i) Construct an analytic function $f(z) = u + iv$ whose real part is $u(x,y) = e^x(xcosy - ysiny)$. (8)

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

Or

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

(ii) Show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^2 = |f'(z)|^2$, if f(z) is a regular function of z. (8)

19. (a) (i) Using Cauchy's integral formula, evaluate $\int_c \frac{sin\pi z^2 + cos\pi z^2}{(z-2)(z-3)}\, dz$, where c is the circle $|z| = 4$. (8)

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

Or

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{13 + 5sin\theta}$ by contour integration. (16)

20. (a) (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) Determine the solution of $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = 10\, sint$, given that $y(0) = 0, y'(0) = 0$. (8)

Or

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

(ii) Compute $y(1,1)$ by using Runge-Kutta method of fourth order, given $\frac{dy}{dx} = y^2 + xy, y(1) = 1$. (8)