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

Question Paper Code: 52002

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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 general solution of the linear differential equation $a_0 \frac{d^n y}{dx^n} + a_1 \frac{d^{n-1}y}{dx^{n-1}} + \cdots + a_n y = X$ is CO1- R

(a) $y =$ Complementary Funtion (b) $y =$ Particular Integral

(c) $y = C.F + P.I$ (d) $y = C.F \times P.I$

2. If n is a positive integer, then $\frac{1}{f(D)}\ x^n$ is equivalent to CO1- R

(a) $\frac{1}{f(-D^2)}\ x^n$ (b) $\frac{1}{f(n)}\ x^n$ (c) $\frac{1}{f(n)}\ x^{-n}$ (d) $[f(D)]^{-1}\ x^n$

3. Del operator is _______________. CO2- R

(a) same as the gradient operator (b) vector differential operator

(c) both (a) and (b) (d) none of these

4. Vector field $\vec{P}$ is irrotational if $\nabla \times \vec{P} =$ ________. CO2- R

(a) ∞ (b) -1 (c) 1 (d) 0

5. A single valued function w = f(z) of a complex variable z is said to be analytic at a point z_o if it has CO3- R

(a) Second derivative at z_o (b) a unique derivative at z_o

(c) Second derivative at z (d) a unique derivative at z.

6. Which of the following is not true when f(z) = u+iv is analytic at a point CO3- R

i) $u_x = v_y$ at the point ii) $u_y = -v_x$ at the point

iii) $u_{xx} + u_{yy} = o$ at the point iv) u_x, u_y, v_x, v_y are continuous at the point

(a) only i (b) only i and ii (c) all are false (d) all are true

7. Cauchy's integral theorem is also known as CO4- E

(a) Integral formula (b) Cauchy's theorem (c) C-R Equation (d) None of these

8. In Taylor's series taking a=0, the series is reduces to CO4- R

(a) Fourier series (b) Maclaurin's series (c) Laurent's series (d) None of these

9. If f(t) is a periodic function with period T then CO5- E

(a) L(f(t)) = $\frac{1}{1-e^{ST}}\int_0^T e^{st}f(t)dt$ (b) L(f(t)) = $\frac{1}{1-e^{ST}}\int_0^T e^{-st}f(t)dt$

(c) L(f(t)) = $\frac{1}{1-e^{-ST}}\int_0^T e^{-st}f(t)dt$ (d) L(f(t)) = $\frac{1}{1-e^{-ST}}\int_0^T e^{st}f(t)dt$

10. The $L^{-1}\left(\frac{1}{s}\right)$ is CO5- E

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

PART – B (5 x 2= 10Marks)

11. Find the complementary function of $(D^2 - 4D + 3)y = 2\,e^x$. CO1- App

12. State Stoke's Theorem. CO2- R

13. Define Bilinear Transformation. CO3- R

14. State Cauchy' Integral Theorem. CO4- R

15. Find $L[\frac{1}{\sqrt{t}}]$. CO5- R

PART – C (5 x 16= 80Marks)

16. (a) (i) Solve the equation $(D^2 + 6D + 9)y = e^x + sin3x.$ CO1- App (8)

(ii) Solve the equation CO1- App (8)

$x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = 32(logx)^2.$

Or

(b) (i) Solve $\frac{d^2y}{dx^2} + 4y = 4tan2x$ using Method of Variation of parameter. CO1- App (8)

(ii) Solve $(2x+3)^2 \frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x$ CO1- App (8)

17. (a) (i) Find the directional derivative of $\phi = 4xz^2 + x^2yz - 3z$ at the point $(1, -2, -1)$ in the direction $2\vec{\imath} - \vec{\jmath} - 2\vec{k}$. CO2- App (8)

(ii) Show that CO2- App (8)

$\vec{F} = (y^2 + 2xz^2)\vec{\imath} + (2xy - z)\vec{\jmath} + (2x^2z - y + 2z)\overrightarrow{k}$ is irrotational and hence find its scalar potential.

Or

(b) Verify Gauss divergence theorem for $\vec{F} = x^2\vec{\imath} + y^2\vec{\jmath} + z^2\overrightarrow{k}$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$. CO2- App (16)

18. (a) (i) Find the analytic function $w = u + iv$ if $v = e^{2x}(xcos2y - ysin2y)$. Hence find u. CO3- App (8)

(ii) If $f(z)$ is a regular function of z, prove that CO3- App (8)

$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2.$

Or

(b) (i)Show that the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic and determine its conjugate. CO3- App (8)

(ii) Find the bilinear transformation that maps the points $z_1 = 1,\ z_2 = -1,\ z_3 = 1$ into the $w_1 = 0,\ w_2 = 1,\ w_3 = \infty$ respectively. CO3- App (8)

19. (a) (i) Use Cauchy's Integral Formula to evaluate CO4-E (8)

$\int_c \frac{sin\pi z^2 + cos\pi z^2}{(z-1)(z-3)} dz$, where c is the circle $|z| = 4$.

(ii) Identify the singularity of CO4-App (8)

$f(z) = \frac{z^2}{(z-2)^2(z^2+9)}$ and find the residue at each singularity.

Or

(b) (i) Expand CO4-E (8)

$f(z) = \frac{1}{(z+2)(z+1)}$ in a laurent's series if

$i)|z| > 2,\ ii)1 < |z| < 2$

(ii) Obtain Taylor's series to represent the function CO4-App (8)

$f(z) = \frac{(z^2-1)}{(z+2)(z+3)}$ in the region $|z| < 2$

20. (a) (i) Find the Laplace Transform of the rectangular wave given by CO5- App (8)

$f(t) = \begin{cases} 1, & 0 < t < b \\ -1. & b < t < 2b \end{cases}$ with $f(t+2b) = f(t)$.

(ii) Evaluate CO5-E (8)

$L^{-1}\left[\frac{1-S}{(S+1)(S^2+4S+13)}\right]$

Or

(b) (i) Use convolution theorem to find CO5-App (8)

$L^{-1}\left[\frac{1}{(s+1)(s+2)}\right]$

(ii) Using Laplace Transform method to solve CO5-App (8)

$y'' - 4y' + 8y = e^{2t},$

$y(0) = 2,\ \ y'(0) = -2.$