Question Paper Code | 14176

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Second Semester

Electronics and Communication Engineering

(Common to Electrical and Electronics Engineering, Mechanical Engineering & Computer and Communication Engineering)

20BSMA201 - ENGINEERING MATHEMATICS - II

Regulations - 2020

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K-Level	CO

1. The divergence of the vector field $(x - y)\vec{i} + (y - z)\vec{j} + (x + y + z)\vec{k}$ is — *1 K2 CO1*
   (a) 0   (b) 1   (c) 2   (d) 3

2. Which of the following is the value of $\nabla(r^n)$? — *1 K1 CO1*
   (a) $nr^{n-2}\vec{r}$ (b) $r^{n-2}\vec{r}$ (c) nr^{n-2} (d) $nr^{n-1}\vec{r}$

3. When two roots of a differential equation are complex then the Complementary function is — *1 K1 CO2*
   (a) $e^{\alpha x}(C_1 Cos\beta x + C_2 Sin\beta x)$ (b)$(C_1 Cos\beta x + C_2 Sin\beta x)$
   (c) $e^{\alpha x}(C_1 x + C_2 x)$ (d) $e^{\alpha x}(C_1 Cos\beta x - C_2 Sin\beta x)$

4. Cauchy-Euler equation is a linear homogeneous ordinary differential equation with — *1 K1 CO2*
   (a) Polynomial invariants   (b) Variable coefficients
   (c) Constant coefficients   (d) none of these

5. A function u is said to be harmonic if and only if — *1 K1 CO3*
   (a) $u_x + u_y = 0$ (b) $u_{xx} - u_{yy} = 0$ (c) $u_{xx} + u_{yy} = 0$ (d) $u_{xy} + u_{yx} = 0$

6. The necessary and sufficient condition for $w = f(z)$ to be analytic in the region R is — *1 K1 CO3*
   (a) $u_x = v_y, \ u_y = -v_x$ (b) $u_x = -v_y, \ u_y = -v_x$
   (c) $u_x = v_y, \ u_y = v_x$ (d) $u_{xx} = v_y, \ u_{yy} = -v_x$

7. The Residue of $f(z) = \frac{z^3}{(z-1)^4(z-2)(z-3)}$ at $z=3$ is — *1 K2 CO4*
   (a) $\frac{101}{16}$ (b) -8   (c) $\frac{27}{16}$ (d) 0

8. The simple poles for the integral $\int_C \frac{z^2+1}{z^2-2z} dz$ is — *1 K2 CO4*
   (a) $z = 1, 2$ (b) $z = 0, 2$ (c) $z = 0, 1$ (d) $z = 0, -1$

9. The inverse Laplace transform of $\frac{1}{s+a}$ is — *1 K2 CO5*
   (a) e^{at} (b) e^{-at} (c) $e^{a/t}$ (d) $e^{-a/t}$

10. $L(t)$ is — *1 K2 CO5*
    (a) $\frac{1}{s}$ (b) $\frac{1}{s^2}$ (c) $\frac{s}{s^2}$ (d) s

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Show that $\vec{F} = (x + 2y)\vec{i} + (y + 3z)\vec{j} + (x^2 - 2z)\vec{k}$ is solenoidal. — *2 K2 CO1*

12. State Gauss divergence theorem. — *2 K1 CO1*

13. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point $(1, -2, -1)$ in the direction of $2\vec{i} - \vec{j} - 2\vec{k}$. — *2 K2 CO1*

14. Find the particular integral of $(D^2 - 4)y = e^{2x}$. — *2 K2 CO2*

15. Transform $(x + 2)^2 \frac{d^2 y}{dx^2} - (x + 2)\frac{dy}{dx} + y = 3x + y$ into differential equation with constant coefficients. — *2 K2 CO2*

16. Find the solution of $(D^2 - 5D + 6)y = 0$.   2   K2   CO2

17. Prove that an analytic function whose real part is constant must itself be a constant.   2   K2   CO3

18. Find the fixed points of the transformation $w = \frac{6z-9}{z}$.   2   K2   CO3

19. Define Essential singularity.   2   K1   CO4

20. State Cauchy's Residue theorem.   2   K1   CO4

21. Find $L[t^2 e^{-3t}]$.   2   K2   CO5

22. State the sufficient conditions for the Existence of Laplace transform.   2   K1   CO5

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23.   a)   Verify Gauss Divergence theorem for   11   K3   CO1
$\vec{F} = (x^2 - yz)\vec{i} + (y^2 - zx)\vec{j} + (z^2 - xy)\vec{k}$ taken over the rectangular parallelopiped bounded by $x = 0,\ y = 0,\ z = 0$ and $x = a, y = b,\ z = c$.

OR

  b)   Verify Stoke's theorem for $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ taken round the rectangle region in the xy plane bounded by the lines $x = 0,\ x = a,\ y = 0, y = b$.   11   K3   CO1

24.   a)   Solve $(D^2 + 4)y = \sec 2x$ by the method of variation of parameters.   11   K3   CO2

OR

  b)   Solve $x^2 \dfrac{d^2 y}{dx^2} - 3x \dfrac{dy}{dx} + 4y = x^2 + \cos(\log x)$.   11   K3   CO2

25.   a)   Find the analytic function $f(z) = u + iv$ given that $u - v = e^x(\cos y - \sin y)$.   11   K3   CO3

OR

  b)   Find the bilinear transformation that maps the points $z = -2, 0, 2$ into the points $w = 0, i, -i$ respectively.   11   K3   CO3

26.   a)   Expand $\dfrac{1}{z^2 - 3z + 2}$ in the region $(i)\ 1 < |z| < 2$ and $(ii) |z| > 2$.   11   K3   CO4

OR

  b)   Evaluate $\int_0^\infty \dfrac{x^2 dx}{(x^2 + a^2)(x^2 + b^2)}, a > 0, b > 0$ using contour integration.   11   K3   CO4

27.   a)   Find the Laplace transform of the periodic function   11   K3   CO5
$f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t, & a < t \le 2a \end{cases}$ and $f(t + 2a) = f(t)$.

OR

  b)   Using Laplace transforms, solve $y'' + y' = t^2 + 2t, y(0) = 4, y'(0) = -2$.   11   K3   CO5

28. a) (i)   Evaluate $\int_C \dfrac{dz}{(z+1)^2(z-2)}$, where C is the circle $|z| = \frac{3}{2}$.   6   K5   CO4

  (ii)   Using convolution theorem find $L^{-1}\left[\dfrac{s^2}{(s^2+4)(s^2+9)}\right]$.   5   K3   CO5

OR

  b) (i)   Evaluate $\int_C \dfrac{z^2}{(z-1)^2(z+2)} dz$, where C is the circle $|z| = 3$, using Cauchy's Residue Theorem.   6   K5   CO4

  (ii)   Verify the initial value theorem for the function $f(t) = 3e^{-2t}$.   5   K3   CO5