| Reg. No. | | | | | | | | | | | | |
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| Question Paper Code | 12115 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023**

Second Semester

**Civil Engineering**

(Common to Electronics and Communication Engineering, Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechanical Engineering & Mechanical and Automation Engineering)

**20BSMA201 - ENGINEERING MATHEMATICS - II**

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

***Marks, K-Level, CO***

1. Find 'a' such that $(3x-2y+z)\vec{i}+(4x+ay-z)\vec{j}+(x-y+2z)\vec{k}$ is solenoidal. *2,K2,CO1*
2. State Gauss divergence theorem. *2,K1,CO1*
3. Find the particular integral of $(D^2+4)y=\sin 2x$. *2,K2,CO2*
4. Solve: $x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$. *2,K2,CO2*
5. Show that the function $2x-x^3+3xy^2$ is harmonic. *2,K2,CO3*
6. Find the fixed points of the transformation $w=\frac{3z-4}{z-1}$. *2,K2,CO3*
7. Evaluate : $\int_C \frac{z\,dz}{z-2}$, where C is the circle $|z|=1$ using Cauchy's integral formula. *2,K2,CO4*
8. Define isolated singularity. *2,K1,CO4*
9. Find $L\left[e^{-3t}+\cosh 3t+\sin 4t\right]$. *2,K2,CO5*
10. Define convolution of two functions on Laplace transform. *2,K1,CO5*

**PART - B (5 × 16 = 80 Marks)**

Answer ALL Questions

11. a) Find the values of the constants a, b, c, so that the vector $\vec{F}=(axy+bz^3)\vec{i}+(3x^2-cz)\vec{j}+(3xz^2-y)\vec{k}$ is irrotational and hence find its scalar potential such that $\vec{F}=\nabla\phi$. *16,K3,CO1*

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*

**OR**

b) Verify Gauss divergence theorem for $\overline{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ over the cube bounded by the planes $x = 0,\ x = 1,\ y = 0,\ y = 1,\ z = 0,\ z = 1.$ 16,K3,CO1

12. a) (i) Solve the equation $(D^2 + 4D + 3) = e^{-x}sinx.$ 8,K3,CO2

(ii) Obtain the general solution of the differential equation $\frac{d^2y}{dx^2} + 4y = \sec 2x$, by using the method of variation of parameters. 8,K3,CO2

**OR**

b) Solve the following differential equation with variable coefficients $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x.$ 16,K3,CO2

13. a) (i) Determine the analytic function $f(z)$ whose imaginary part is $v = e^{-x}(x\cos y - y\sin y)$. 16,K2,C

**OR**

b) (i) Find the image of $|z| = 2$ under the transformation $w = z + 3 + 2i.$ 8,K3,CO3

(ii) Find the bilinear transformation which maps the points $z = 0,\ 1,\ \infty$ into $w = i,\ -1,\ -i$ respectively. 8,K2,CO3

14. a) Expand $f(z) = \frac{z}{(z-1)(z-3)}$ as a Laurent's series valid in the region **(i)** $|z-1| < 2$ **(ii)** $1 < |z| < 3.$ 16,K2,CO4

**OR**

b) Evaluate $\int_C \frac{z-1}{(z+1)^2(z-2)}dz$ where C is the circle $|z-i| = 2$ using Cauchy's residue theorem. 16,K3,CO4

15. a) (i) Find $L\left[t\, e^{3t} \sin 2t\right]$. 6,K2,CO5

(ii) Verify initial and final value theorem for $(t) = 1 + e^{-t}(\sin t + \cos t).$ 10,K3,CO5

**OR**

b) Using Laplace transform evaluate the differential equation $y'' + y = t^2 + 2$, $y(0) = 4,\ y'(0) = -2.$ 16,K3,CO5

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*