Q. Code:340449

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

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

MA18251 – ENGINEERING MATHEMATICS – II

(Common to all branches except MR)

(Regulation 2018 / 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO1	Interpret the fundamentals of vector calculus and be fluent in the use of Stokes theorem and Gauss divergence theorem.
CO2	Express proficiency in handling higher order differential equations.
CO3	Determine the methods to solve differential equations using Laplace transforms and inverse Laplace transforms.
CO4	Explain analytic functions and categorize transformations.
CO5	Solve complex integrals using Cauchy integral theorem and Cauchy's residue theorem.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	If $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$, then prove that $\nabla(\log r)=\frac{\vec{r}}{r^2}$.	1	2
2.	Find the value of a if $\vec{F}=(2x-5y)\vec{i}+(x+ay)\vec{j}+(3x-z)\vec{k}$ is solenoidal.	1	2
3.	Solve $(D^3+3D^2-4)y=0$.	2	3
4.	Solve $\left[(x+1)^2D^2+(x+1)D+1\right]y=0$.	2	3
5.	Find $L[\cosh t\cos 2t]$	3	2
6.	Find $L^{-1}\left[\frac{s+3}{s^2}\right]$.	3	2
7.	Test the analyticity of $f(z)=z^2$.	4	2
8.	Find the invariant points of $w=\frac{2z-5}{z+4}$.	4	2
9.	Evaluate $\int_C \frac{4z^2-6z+1}{z-4}\,dz, C:\|z-1\|=2$.	5	2
10.	What is the nature of the singularity at $z=0$ of $f(z)=\frac{\sin z-z}{z^3}$.	5	2

PART- B (5 x 14 = 70 Marks)

			Marks	CO	RBT LEVEL
11. (a)	**(i)**	Find the directional derivative of $xyz-xy^2z^3$ at the point $(1,2,-1)$ in	**(6)**	1	3

the direction of the vector $\vec{i}-\vec{j}-3\vec{k}$.

	(ii)	Find the values of a,b,c so that $\vec{F}=(axy+bz^3)\vec{i}+(3x^2-cz)\vec{j}+(3xz^2-y)\vec{k}$ may be irrotational. For those values of a,b,c, find its scalar potential.	**(8)**	**1**	**3**
		(OR)			
(b)		Verify Gauss divergence theorem for $\vec{F}=x^2\vec{i}+z\vec{j}+yz\vec{k}$ over the cube formed by $x=\pm 1, y=\pm 1, z=\pm 1$.	**(14)**	**1**	**3**
12. (a)	**(i)**	Solve $(D^2-3D+2)y=2\cos(2x+3)+2e^x$.	**(7)**	**2**	**3**
	(ii)	Solve $(D^2+4)y=\cot 2x$ using method of variation of parameter.	**(7)**	**2**	**3**
		(OR)			
(b)	**(i)**	Solve $[x^2D^2-xD+1]y=\left[\frac{\log x}{x}\right]^2$.	**(7)**	**2**	**3**
	(ii)	Solve $\frac{dx}{dt}+2x-3y=5t, \frac{dy}{dt}-3x+2y=0$.	**(7)**	**2**	**3**
13. (a)	**(i)**	Find $L[e^{-t}t^2\sin t]$.	**(7)**	**3**	**3**
	(ii)	Solve $(D^2+2D-3)y=\sin t$ given that $y(0)=0$ and $y'(0)=0$ using Laplace transforms method.	**(7)**	**3**	**3**
		(OR)			
(b)	**(i)**	Find the Laplace transform of $f(t)=\begin{cases}\sin \omega t, 0<t<\frac{\pi}{\omega}\\ 0, \frac{\pi}{\omega}<t<\frac{2\pi}{\omega}\end{cases}$ and $f\left(t+\frac{2\pi}{\omega}\right)=f(t)$.	**(7)**	**3**	**3**
	(ii)	Using convolution theorem, find $L^{-1}\left[\frac{1}{s^2(s+3)}\right]$.	**(7)**	**3**	**3**
14. (a)	**(i)**	If $f(z)$ is an analytic function, prove that $\nabla^2\lvert f(z)\rvert^2=4\lvert f'(z)\rvert^2$.	**(7)**	**4**	**3**
	(ii)	Find the bilinear transformation that maps the points $-1,0,1$ onto the	**(7)**	**4**	**3**

points $-1,-i,1$.

(OR)

			Marks	CO	RBT LEVEL
(b)	**(i)**	Find the analytic function $f(z)$ where $u-v=e^{x}(\cos y-\sin y)$ and $f(0)=1$.	**(7)**	**4**	**3**
	(ii)	Find the image of the half-plane $x>c$ when $c>0$ under the transformation $w=\frac{1}{z}$.	**(7)**	**4**	**3**
15. (a)	**(i)**	Evaluate $\int_{C} \frac{z+1}{z^2+2z+4}dz, C:\lvert z+1+i\rvert=2$ using Cauchy's integral formula.	**(7)**	**5**	**3**
	(ii)	Evaluate $\int_{C} \frac{dz}{(z^2+4)^2}, C:\lvert z-i\rvert=2$ using Cauchy's residue theorem.	**(7)**	**5**	**3**
		(OR)			
(b)	**(i)**	Obtain the Laurent's series expansion of $\frac{1}{(z+1)(z+3)}$ *for* $1<\lvert z\rvert<3$.	**(4)**	**5**	**3**
	(ii)	Evaluate $\int_{0}^{2\pi} \frac{d\theta}{5+4\cos\theta}$ using contour method.	**(10)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Verify Green's theorem in the XY plane for $\int_{C} (xy+y^2)dx+x^2 dy$ where C is the closed curve of the region bounded by $y=x \wedge y=x^2$.	**(10)**	**1**	**3**

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