QP CODE: D3BMT2405	**(Pages: 2)**	**Reg. No**	**:**	**.....**
		Name	**:**	**.....**

THIRD SEMESTER FYUGP EXAMINATION, NOVEMBER 2025

Discipline Specific Core (DSC) Course - Minor

MAT3MN202 : Differential Equations and Fourier Series

(Credits: 4)

Time: 2 Hours **Maximum Marks: 70**

Section A

Answer the following questions. Each carries 3 marks (Ceiling: 24 marks)

1.	Determine whether the given differential equation is exact. If it is exact, solve it. $(5x+4y)dx+(4x-8y^3)dy=0.$	BL2	CO1
2.	Find the general solution of the given second-order differential equation: $y''+8y'+16y=0$	BL2	CO1
3.	Expand $f(x)=x^2, 0<x<2\pi$ in a Fourier series.	BL2	CO2
4.	Express $1-\sqrt{3}i$ in polar form.	BL2	CO3
5.	Find product solutions of $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=0$	BL2	CO2
6.	Solve the given differential equation by using an appropriate substitution: $(y^2+yx)dx-x^2dy=0.$	BL2	CO1
7.	Define a Cauchy–Euler differential equation. State the different cases for the solution depending on the nature of the roots of the auxiliary equation.	BL1	CO1
8.	Expand $f(x)=\begin{cases}-1 & \text{if } -\pi<x<0\\ 2 & \text{if } 0\le x<\pi\end{cases}$ in Fourier series.	BL2	CO2
9.	Verify that the indicated function is a solution of the given differential equation: $y''-2y'+y=0;\ y=xe^x$	BL2	CO1
10.	Express the function $f(z)=6z+\frac{1}{z}-5+9i$ in the form $f(z)=u+iv$	BL2	CO3

Section B

Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)

11.	Solve the initial-value problem $\cos x(e^{2y}-y)\frac{dy}{dx}=e^y\sin 2x,\ y(0)=0.$	BL2	CO1, CO2
12.	Find a particular solution of $y''-5y'+4y=8e^x.$	BL2	CO1

(PTO)

13.	Classify the following equations as hyperbolic,parabolic,or elliptic. (a) $3\frac{\partial^2 u}{\partial x^2}+5\frac{\partial^2 u}{\partial x\partial y}+\frac{\partial^2 u}{\partial y^2}=0$ (b) $\frac{\partial^2 u}{\partial x^2}+6\frac{\partial^2 u}{\partial x\partial y}+9\frac{\partial^2 u}{\partial y^2}=0$ (c) $\frac{\partial^2 u}{\partial x\partial y}-\frac{\partial^2 u}{\partial y^2}-2\frac{\partial^2 u}{\partial x^2}=0$	BL2	CO2
14.	Sketch the set of points in the complex plane satifying the inequality $2<Re(z-1)<4$. Define domain and determine whether the set is a domain.	BL2	CO3
15.	Show that the function $f(z)=3x^2y^2-6x^2y^2i$ is not analytic at any point but is differentiable along the coordinate axes.	BL2	CO3
16.	Solve the initial-value problem $\frac{dy}{dx}+y=x,\ y(0)=4.$	BL2	CO1
17.	Determine whether the given set of functions is linearly dependent or linearly independent on the interval $(-\infty,\infty)$. (i) $f_1(x)=1+x, f_2(x)=x, f_3(x)=x^2$ (ii) $f_1(x)=5, f_2(x)=\cos^2 x, f_3(x)=\sin^2 x$	BL2	CO1
18.	(a) Define Fourier cosine and sine series. (b) Expand the function $f(x)=\begin{cases}x-1 & \text{if } -\pi<x<0\\ x+1 & \text{if } 0\le x<\pi\end{cases}$ in an appropriate cosine or sine series.	BL2	CO2
	Section C		
	Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)		
19.	(i) Verify that $y_{p_1}=3e^{2x}$ and $y_{p_2}=x^2+3x$ are, respectively, particular solutions of $y''-6y'+5y=-9e^{2x}$ and $y''-6y'+5y=5x^2+3x-16$. (ii) Use part (i) to find particular solutions of $y''-6y'+5y=5x^2+3x-16-9e^{2x}$ and $y''-6y'+5y=-10x^2-6x+32+e^{2x}$.	BL2	CO1
20.	(a) Find a complex number z satisfying the given equation $z-2\bar{z}+7-6i=0$ (b) Determine which of the complex number $10+8i, 11-6i$ is closer to the origin. (c)Let $z=x+iy$, Find the expression $Re(z^2)$	BL2	CO3
	CO : Course Outcome		
	BL : Bloom's Taxonomy Levels (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)		