BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS:	**IMSC**	**SEMESTER : III**
BRANCH:	**QEDS**	**SESSION : MO/2022**

SUBJECT: ED201 DIFFERENTIAL EQUATIONS

TIME:	**3:00 Hours**	**FULL MARKS: 50**

INSTRUCTIONS:
1. **The question paper contains 5 questions each of 10 marks and total 50 marks.**
2. **Attempt all questions.**
3. **The missing data, if any, may be assumed suitably.**
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. **Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

				CO
Q1	(a)	Find the general solution of the following differential equation $$(D^2+2)y = x^2e^{3x} + e^x\cos 2x, \qquad \text{where } D \equiv \frac{d}{dx}.$$	[5]	CO2
	(b)	Using appropriate transformation, reduce the following equation into a linear differential equation with constant coefficients, and hence the solve the equation. $$(5+2x)^2y'' - 6(5+2x)y' + 8y = 8(5+2x)^2.$$	[5]	CO2
Q2	(a)	Show that $\frac{1}{3x^3y^3}$ is an integrating factor of the differential equation $\boldsymbol{y(xy+2x^2y^2)dx + x(xy-x^2y^2)dy = 0}$, and hence solve it.	[3]	CO1
	(b)	Solve the differential equation $\boldsymbol{(D^2-1)y = 1}$, given that $\boldsymbol{y(0)=0}$ and $\boldsymbol{y}$ tends to a finite limit as $\boldsymbol{x \to -\infty}$.	[2]	CO1
	(c)	Using Laplace transform, evaluate the integral $\boldsymbol{\int_0^\infty \frac{e^{-t}\sin t}{t}\,dt}$.	[5]	CO4
Q3	(a)	Evaluate the power series solution of the following differential equation about $x=0$. $$(1-x^2)y'' - 2xy' + 2y = 0.$$	[7]	CO3
	(b)	Classify the ordinary point, regular singular point, and irregular singular point at $\boldsymbol{x=-2}$ for the following differential equation $$x(x-1)^2(x+2)y'' + x^2y' - (x^3+2x-1)y = 0.$$	[3]	CO3
Q4	(a)	Given that $f(t+2\pi) = f(t)$. Find the Laplace transform of the function $$f(t) = \begin{cases} \sin t, & 0 < t < \pi \\ 0, & \pi < t < 2\pi. \end{cases}$$	[4]	CO4
	(b)	Using Laplace transform, solve the following initial value problem. $$y'' - 3y' + 2y = e^{-t}, y(0) = 1, y'(0) = 0.$$	[6]	CO4
Q5		Solve the following system of homogeneous linear differential equations by finding eigenvalue and eigenvectors of the coefficient matrix. $$\begin{pmatrix} y_1'(x) \\ y_2'(x) \\ y_3'(x) \end{pmatrix} = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix}.$$	[10]	CO5

:::::21/11/2022:::::E