



OFFICE OF THE VICE PRESIDENT FOR ACADEMICS AND PROGRAM IMPLEMENTATION

**INSTITUTE OF ENGINEERING
LONG TEST
CEMAT104: DIFFERENTIAL EQUATIONS**

Name		ID No.	
Section		Date	

GENERAL DIRECTIONS:

1. Be on time. Latecomers will not be allowed to take the exam.
2. Use of calculators, gadgets, and reference materials are not allowed. Upon inspection, all accessories, watches, IDs and other stuffs must be placed in the bags.
3. Provide what is/are asked from the following problems. Use black/blue pen.
4. Scratch papers and answer sheets (**FOR FINAL AND COMPLETE COMPUTATIONS AND SOLUTIONS**) shall be provided by the proctor. Students are not allowed to bring extra papers. Should the students need additional sheets, they must ask the assigned proctor. The first bond paper is for FINAL COMPUTATIONS and ANSWERS, while the last bond papers are for draft computations (scratch papers). Write your names in and label (final or scratch) the bond papers.
5. The point distribution for every set of complete computations and correct solutions is one point each.
6. Once the exam has started, no one shall be allowed to leave the room for whatever/any reason. Should the students insist/request to leave, they need to submit their papers, and that concludes their examination time.
7. Any form of dishonesty will never be tolerated.

A. Identify the order and degree of the following DE (solve, if applicable):

#	Problem	#	Problem
1	$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$	4	$\ln\left(\frac{d^2 y}{dx^2}\right) + \frac{dy}{dx} = x$
2	$\sin\left(\frac{dy}{dx}\right) = x$	5	$\left(\frac{d^2 y}{dx^2}\right)^{-1} + \frac{dy}{dx} = x \frac{d^2 y}{dx^2} + \cos x$
3	$\frac{3x^2}{\sqrt{\frac{d^3 y}{dx^3} + \left(\frac{d^2 y}{dx^2}\right)^2}} = 7y$	6	$\left[y + x \left(\frac{d^2 y}{dx^2}\right)^2\right]^{4/3} = x \left(\frac{dy}{dx}\right)$

B. Identify if the DE are linear or nonlinear. State the reason/s for nonlinearity:

#	Problem	#	Problem
7	$y''' + e^x y' + y = \sin x$	10	$y'' + \cos(x + y) = e^x$
8	$x \frac{d^2 y}{dx^2} + y = 7$	11	$\frac{dy}{dx} + \frac{3x^2 - 1}{x + y} = 0$
9	$\sqrt{\frac{dy}{dx}} + 3y = \cos x$	12	$(x^2 + y^2)dx + 2xydy = 0$





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C. Verify the solutions:

13. Is $x^2 = 4 - 4y$ a particular solution of $\left(y + \sqrt{x^2 + y^2}\right) dx - xdy = 0$?

14. Show that $2y = x^5 + cx^3$ is a solution of $(x^5 + 3y)dx - xdy = 0$.

15. Is $y = Ae^x + Bxe^x$ a solution of $y'' + 4' - 4y = 0$?

16. Show that $2y = x^2 - 1 + 2e^{1-x^2}$ is a solution of $y' = x^3 - 2xy$

17. Show that $(x - 3y + 2) dx + 3(x + 3y - 4)dy = 0$ has $\ln[(x - 1)^2 + 9(y - 1)^2] - 2\tan^{-1} \left[\frac{x-1}{3(y-1)} \right] = C$ as one of its solutions.

D. Eliminate the arbitrary constant (verify the solutions).

#	Problem	#	Problem
18	$y = Ae^{4x} + Bxe^{4x}$	20	$y = C_1 e^{3x} \cos 2x + C_2 e^{3x} \sin 2x$
19	$x = c_1 \cos \omega t + c_2 \sin \omega t$ $+ c_3 \cos \omega t$ ω is a parameter	21	$y = c_1 x^2 + c_2 e^{-2x}$

E. Obtain the DE of the following families of curves (provide the graphical representations):

22. Straight lines at a fixed distance Q from the origin

23. Circles with fixed radius r and tangent to the y-axis

24. Circle of radius unity

25. Parabolas with axis parallel to the x-axis and with distance from vertex to focus fixed as a.

