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National University of Computer and Emerging Sciences, Lahore Campus			
	Course:	Diff. Eq. (Cal-II)	Course Code: MT-1006
	Program:	BS(CS)/BS(DS)	Semester: Spring 2022
	Duration:	3 hours	Total Marks: 70
	Date:	10/06/22	Weight 50%
	Section:	All	Page(s): 2
	Exam:	Final	Roll No:
Name:			

Note: Attempt all questions. Use of programmable calculators is not allowed. Exchange of stationary is strictly prohibited. Best of luck!

Question no. 1: (CLO-01) (10 marks)

a) Use ratio test to determine if the series

$$\sum_{n=2}^{\infty} \frac{3^{n+2}}{\ln n}$$

converges or diverges.

b) Ayesha puts 1 coin on the first square of an 8×8 chess board. Then she puts double the amount of coins in each successive square thereafter. How many coins would be on the 64_{th} square?

Question no. 2: (CLO-02) (10 marks) Solve the given initial value problem.

$$L\frac{dy}{dt} + Ry = E, y(0) = y_0$$

where L, R, E and y_0 are constants.

$\frac{dT}{dt} = k(T_s - T_m)$

Question no. 3: (CLO-02) (10 marks) Suppose that in winter the daytime temperature in a certain office building is maintained at 70°F. The heating is shut off at 10 P.M. and turned on again at 6 A.M. On a certain day the temperature inside the building at 2 A.M. was found to be 65°F. The outside temperature was 50°F at 10 P.M. and had dropped to 40°F by 6 A.M. What was the temperature inside the building when the heat was turned on at 6 A.M.?

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Question no. 4: (CLO-03) (10 marks) Determine the solution of the given differential equation

$$y'' + y' = x + \sin 2x$$

using undetermined coefficients superposition principle.

Question no. 5: (CLO-03) (10 marks) Solve the Cauchy Euler equations using variation of parameters

$$x^2y'' + xy' - y = x^2e^{2x}$$

Question no. 6: (CLO-04) (10 marks) Find the Fourier series for the function

$$f(x) = \begin{cases} x^2 & 0 \le x < \pi \\ -x^2 & -\pi < x < 0 \end{cases}$$

Question no. 7: (CLO-04) (10 marks) Solve the wave equation subject to given conditions:

$$u(0,t) = 0, u(2,t) = 0; t > 0$$

$$u(x,0) = x(2-x); 0 < x < 2$$

$$\frac{\partial u}{\partial t} = 0 \text{ at } t = 0$$