National University of Computer and Emerging Sciences, Lahore Campus				
	Course:	Differential Equations(Calculus-II)	Course Code:	MT 224
	Program:	BS (CS, SE, DS)	Semester:	Spring
	Duration:	3 hours	Total Marks:	100
	Paper Date:	01-07-2021	Weight	70%
	Section:	All	Page(s):	1
	Exam:	Final	Roll No:	
Instruction/Notes:	Attempt All Questions, Exchange of calculators or programmable calculators not allowed at all.			
Student Name:				

Question:1[CLO:1, 5] **[10+10marks]**

a. Use any method to determine if the series converges or diverges.

$$\sum_{n=1}^{\infty} \frac{n!2^n}{n^n}$$

b. Find Fourier series of f on the given interval.

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ 1, & 0 \le x < \pi \end{cases}$$

Question:2[CLO:2, 3] **[10+10marks]**

Solve the following differential equations.

a. $ydx = 4(x + y^6)dy, y(1) = 1$

b. $(y^2 + yx)dx + x^2dy = 0.$

Question:3[CLO: 3] **[10+10marks]**

a. A certain culture of bacteria grows at rate proportional to its size. If the initial size is p_0 which doubles in 4 days, find the time required for the culture to increase to 10 times to its initial size.

b. Solve the following Cauchy Euler Equation.

$$x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 0$$

Question:4[CLO: 4] **[20marks]**

Solve the given differential equation subject to the indicated condition by method of undetermined coefficients by any approach.

$$y'' - y = x + sinx \quad , y(0) = 2, \; y'(0) = 3$$

Question:5[CLO: 5] **[20marks]**

Find the product solutions for the given Partial Differential Equation using Separation of Variables Method.

$$k\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$$

Subject to the conditions: $u(0, t) = 0, u(L, t) = 0, u(x, 0) = x(L - x)$