BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environment, Water and Coastal Engineering
Term Final (Fall) Examination 2022: Jan-Feb 2023

Student Group: 0<Earned Credit Hours ≤ 36

Subject: MATH-103, Differential Equations and Matrix

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory
c. Answer any other **TWO** questions out of **THREE** from each section.
d. Figures in the margin indicate full **marks.**
e. Assume reasonable data if necessary.
f. **Symbols** and **abbreviations** used have their usual meanings.

SECTION-A

Question 1 (Compulsory)

a. Define the followings with example: **06**
   (i) Ordinary Differential Equation.
   (ii) Order and Degree of a Differential Equation.

b. Find the differential equation whose solution is $y^2 = 4a(x + a)$, where a is an arbitrary constant. **12**

c. Define Lagrange's equation and solve $y = (1 + p)x + p^2$, where $p = \frac{dy}{dx}$. **12**

Question 2

a. Solve the following differential equations: **20**
   (i) $y\sqrt{x^2 - 1}dx + x\sqrt{y^2 - 1}dy = 0$
   (ii) $\frac{dy}{dx} + \frac{y}{x} = x^2$

b. Define Bernoulli's differential equation and solve $\frac{dy}{dx} + \frac{y}{x} = x^2y^7$. **10**

Question 3

a. Solve the following differential equations: **30**
   a. $(D^2 - 9D + 20)y = 20x$
   b. $(D^2 + 2D + 2)y = 10sin4x$
   c. $(D^2 - 1)y = x^2cosx$

Question 4

a. Solve the following differential equation: **15**
$$(x^3D^3 - 3x^2D^2 - 2xD + 2)y = 0.$$

b. Use the power series method to find the general solution of the differential equation $4xy'' + 2y' + y = 0$. **15**