International Islamic University Chittagong (IIUC)

Department of Computer and Communication Engineering

Final Examination

Program: **B.sc (Engg.)**
Course Code: **MATH-1201**
Total Marks: **50**

Semester: **Autumn 2022**
Course Title: **MATHEMATICS- II**
Time: **2 Hours 30 Minutes**

(i) Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

CLO2	Solve differential equations using various methods
CLO3	Formulate the mathematical model and interpret the results by analyzing the real-world problems related to Growth and Decay Problems, Temperature Problems, Falling Body Problems, Dilution Problems, Electrical Circuits Problems etc. through a set of differential equations.

Bloom's Levels of the Questions

Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

Answer <u>Two</u> of the following Questions.

Q1.	**a)**	Define differential equation with example. Form the differential equation whose solution is given by, $y = ax + bx^2$.	**CLO2**	**R & U**	**5**
	b)	Solve the differential equation $y - x\frac{dy}{dx} = a\left(y^2 + \frac{dy}{dx}\right)$ using variable separable method.	**CLO2**	**E**	**5**
Q2.	**a)**	Define linear differential equation and solve the differential equation $x\frac{dy}{dx} + 2y = x^2 logx$.	**CLO2**	**R & E**	**5**
	b)	Test whether the differential equation, $(1 + e^{x/y})dx + e^{x/y}(1 - x/y)dy = 0$ is exact or not hence solve it.	**CLO2**	**E**	**5**

OR

Q2.	**a)**	Define Bernoulli differential equation and solve $\frac{dy}{dx} = x^3y^3 - xy$.	**CLO2**	**R & E**	**5**
	b)	Solve the linear differential equation with constant coefficients, $$\frac{d^4y}{dx^4} - a^4y = 0$$	**CLO2**	**E**	**5**

Part B

Answer <u>Three</u> of the following Questions.

Q3.	**a)**	Define Bessel's equation and prove that, $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} sinx$.	**CLO2**	**R & E**	**5**
	b)	Using method of variation parameter solve $y'' + y = cosecx$.	**CLO2**	**E**	**5**

Q4.	**a)**	Define Legendre's generating function and show that $P_n(1) = 1$ and $P_n(-1) = (-1)^n$.	**CLO2**	**R & E**	**5**
	b)	Solve the differential equation $(D^2 - 2D + 3)y = x^3 + sinx$ using method of undetermined coefficients.	**CLO2**	**E**	**5**
Q5.	**a)**	Define partial differential equation with example. Form a differential equation by eliminating arbitrary constant from $z = ax^3 + by^3 + ab$.	**CLO2**	**R & E**	**4**
	b)	Solve the non-linear partial differential equations by **Charpit's method,** $2xz - px^2 - 2qxy + pq = 0$.	**CLO2**	**E**	**6**

OR

Q5.	**a)**	Bacteria in a certain culture increases at a rate proportional to the number present. If the number doubles in one hour, how long does it take for the number to triple?	**CLO3**	**Ap**	**5**
	b)	The body of a murder victim was discovered at **11:00 pm**. The doctor took the temperature of the body at **11:30 pm** which was $94.6°$**F**. He again took temperature after one hour when showed $93.4°$**F** and noticed that the temperature of the room was $70°$**F**. Estimate the time of death. (Normal temperature of human body is **98.6°F**).	**CLO3**	**Ap**	**5**