

**NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**  
**Even Semester Mid-term Examination, 2021-22**

Course Code: MAC02

Full Marks: 25

Course Name: Mathematics-II

Time: 90 Minutes

Question Paper No.: NITDGP/MAC02/

Date of Exam: 30/05/2022

Symbols have their usual meanings. Brief and to the point answers are preferred.

Instructions: Answer any **FIVE** questions.

Materials to be supplied: No extra material is required.

Question No.	Body of the Question	Marks	Mapped CO
1	Find the Fourier series for the function $f(x) = x + x^2$ , $-\pi < x < \pi$ and $f(x) = f(x + 2\pi) \forall x \in \mathbb{R}$ . Hence show that $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}.$	5	CO 3
2	A professor gives only two types of exams, "easy" and "hard". You will get a hard exam with probability 0.80. The probability that the first question on the exam will be marked as difficult is 0.90 if the exam is hard and is 0.15 otherwise. What is the probability that the first question on your exam is marked as difficult? What is the probability that your exam is hard given that the first question on the exam is marked as difficult?	2+3	CO 4
3	The life of army shoes is 'normally' distributed with mean 8 months and standard deviation 2 months. If 5000 pairs are issued how many pairs would be expected to need replacement after 12 months? [Given that $P(z \geq 2) = 0.0228$ ].	5	CO 4
4	Solve the simultaneous differential equations given by $\frac{dx}{x^2 + y^2} = \frac{dy}{2xy} = \frac{dz}{(x + y)z}.$	5	CO 2

Question No.	Body of the Question	Marks	Mapped CO
5	Solve the ODE $\frac{d^2y}{dx^2} - y = x \sin x + (1 + x^2)e^x.$	5	CO 2
6	Find the general and singular solution of $y + px = x^4 p^2; \quad p = \frac{dy}{dx}.$	5	CO 2
7	(a) Is the set of $n \times n$ real non-singular matrices forms a group under matrix addition? Justify your answer. (b) Check whether the set $G = \{z \in \mathbb{C} :  z  = 1\}$ forms a group with respect to multiplication.	2+3	CO 1

### Course Outcomes

CO1: Develop the concept of basic linear algebra and matrix equations so as to apply mathematical methods involving arithmetic, algebra, geometry to solve problems.

CO2: To acquire the basic concepts required to understand, construct, solve and interpret differential equations.

CO3: Develop the concepts of Laplace transformation & Fourier transformation with its property to solve ordinary differential equations with given boundary conditions which are helpful in all engineering & research work.

CO4: To grasp the basic concepts of probability theory.