HOME ASSIGNMENT (2024 Batch)
MA/MSC IN MATHEMATICS
(FOURTH SEMESTER)
CENTRE FOR DISTANCE AND ONLINE EDUCATION
DIBRUGARH UNIVERSITY

(Full Marks 20 for each course)

Course: MATH-401 (Functional Analysis)

Assignment 1 (10)
(i)

Define a **Banach space**. Show that the space ℓ^p (for $1 \le p < \infty$) with the norm

$$\|x\|_p = \left(\sum_{k=1}^{\infty} |x_k|^p \right)^{1/P}$$

is a normed linear space.

Assignment 2 (5+5)

(i) Define **self-adjoint operators** and **unitary operators** on Hilbert spaces. Give one example of each.

(ii) State and explain the **Projection Theorem** in a Hilbert space. Illustrate with an example in R^3.

Course: MATH-402 (Computer programme)

Assignment 1 (5+5)
(i) Explain with examples the difference between the **while loop** and the **do-while loop** in C.
(ii) Draw a **flowchart** and write an **algorithm** to find the largest of three given numbers.

Assignment 2 (5+5)

(i) Write a C program to **check whether a given number is prime or not** using decision-making statements.

(ii) Write a C function to compute the **factorial of a number** using recursion.

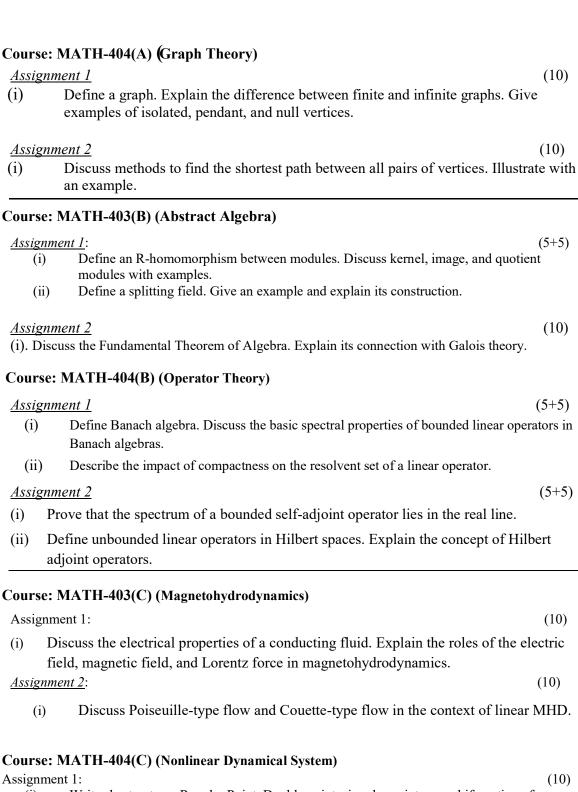### Course: MATH-403(A) (Number Theory)
Assignment 1 10)

(i) State and prove **Euler's Criterion** for quadratic residues. Use it to determine whether 7 is a quadratic residue modulo 19.

Assignment 2:

(i) (10)

Find all integer solutions of the **Diophantine equation**:

$$12x + 18y = 30.$$

Course: MATH-404(A) (Graph Theory)

Assignment 1   (10)

(i)   Define a graph. Explain the difference between finite and infinite graphs. Give examples of isolated, pendant, and null vertices.

Assignment 2   (10)

(i)   Discuss methods to find the shortest path between all pairs of vertices. Illustrate with an example.

Course: MATH-403(B) (Abstract Algebra)

Assignment 1:   (5+5)

(i)   Define an R-homomorphism between modules. Discuss kernel, image, and quotient modules with examples.

(ii)   Define a splitting field. Give an example and explain its construction.

Assignment 2   (10)

(i). Discuss the Fundamental Theorem of Algebra. Explain its connection with Galois theory.

Course: MATH-404(B) (Operator Theory)

Assignment 1   (5+5)

(i)   Define Banach algebra. Discuss the basic spectral properties of bounded linear operators in Banach algebras.

(ii)   Describe the impact of compactness on the resolvent set of a linear operator.

Assignment 2   (5+5)

(i)   Prove that the spectrum of a bounded self-adjoint operator lies in the real line.

(ii)   Define unbounded linear operators in Hilbert spaces. Explain the concept of Hilbert adjoint operators.

Course: MATH-403(C) (Magnetohydrodynamics)

Assignment 1:   (10)

(i)   Discuss the electrical properties of a conducting fluid. Explain the roles of the electric field, magnetic field, and Lorentz force in magnetohydrodynamics.

Assignment 2:   (10)

(i)   Discuss Poiseuille-type flow and Couette-type flow in the context of linear MHD.

Course: MATH-404(C) (Nonlinear Dynamical System)

Assignment 1:   (10)

(i)   Write short note on Regular Point, Double point, singular point, cusp, bifurcation of a system.

Assignment 2:   (10)

(i)   Explain Lyapunov's method for stability of equilibrium points.

-----------000-----------