Course Code	ADU4303

Level	04
Course Title	Applied linear algebra & differential equations
Credit Value	3
Core/Optional	Core
Prerequisites	ADU3202(Passed or Valid OCAM)

Hourly Breakdown	Theory		Practical hours	Independent Learning	Assessments	Total hours
	25*2 = 50 hours	DS hours 4*3 =12 hours	__	25*3 = 75 hours Online learning - 5 Recommended readings -6	CA - 2 hours	150

Course Aim	Apply the techniques of linear algebra to solve system of linear ordinary differential equations and solve system of linear partial differential equations
Programme Learning Outcomes (PLO) addressed by course	**PLO1: Knowledge:** Explain the fundamental, principles and broader knowledge pertaining to the chosen science disciplines offered for the degree. **PLO3: Communication**: Demonstrate the competency in communicating efficiently and effectively to present information, ideas and concepts to the scientific community as well as to the wider society. **PLO5: Creativity and Problem Solving:** Identify and analyze problems using quantitative and/or qualitative approaches using scientific methodology to provide valid conclusions. **PLO9: Lifelong Learning**: Develop the capacity to foresee new trends and their impacts and continuously update knowledge and develop skills willingly to meet those future challenges.
Course Learning Outcomes (CLO)	At the completion of this course student will be able to CLO1: define some types of real and complex matrices and recognize its arithmetic properties (PLO1) CLO2: find the determinant of a square matrix and recognize its properties, Obtain the inverse of a matrix using the adjoint of a matrix and by elementary transformation (PLO1,5) CLO3: obtain a normal form of a matrix and find the rank of a matrix (PLO1,5) CLO4: solve a system of homogeneous and non-homogeneous equations using different technics(PLO1,3,5,9) CLO5: find the eigenvalues and eigenvectors of a matrix and their properties, diagonalize a matrix when it is possible (PLO1,3,5,9) CLO6: determine positive and negative definiteness, nature, index and signature of quadratic forms. (PLO1,3,5,9) CLO7: Convert a quadratic form into canonical form by orthogonal transformations (PLO1,3,5,9) CLO8: express a given system of linear differential equations in matrix form and find the solution of homogeneous and inhomogeneous systems of first order differential equations with constant coefficients. (PLO1,3,5,9) CLO9: obtain the solution of second order homogeneous systems of differential equations (PLO1,3,5) CLO10: solve boundary value problems using differential equations (PLO1,3,5,9) CLO11: find the general solutions of the first Order and second order partial differential equations directly or by using different technics.(PLO1,3,5,9)
Content (Main topics, Sub topics)	**Applied Linear Algebra** Introduction to matrices, Determinants, Rank of a matrix, Inverse of a matrix, Normal form, System of linear non-homogeneous equations, Gaussian elimination method and Gauss-Jordan elimination method, System of homogeneous equations, Eigenvalues and eigenvectors, Cayley-Hamilton theorem, Diagonalisation powers of a matrix, Quadratic form, Index Signature and classification of definiteness, Complex matrices **Differential Equations** System of first order differential equations, Further methods for linear first order system, Second order homogeneous system, forced oscillations, solution of second order differential equation by change of variable, Boundary value problems, The solution of first order partial differential equations, Transforming partial differential equations, The method of characteristics for first order partial differential equations, Solution of second order partial differential equations, General linear second order partial differential equations, Method of separation of variables

Teaching – Learning methods	Self-Learning/independent learning of Self-study • Instructional Material (IL) • Online Activities (OL) • Reference Work (RF) Compulsory contact sessions • Assessments (AS) and Feedback-MCQs(MCQ); Structured Essay (SEQ); Essay Questions (ES); Non-compulsory contact sessions • Day Schools (DS)

Assessments Criteria	Overall Continuous Assessment Mark (OCAM): 40%	Final Assessment (FA): 60%
	Details: Continuous Assessment1 (CAT1):- 1hr Continuous Assessment2 (CAT2):- 1hr OCAM=60% Maximum(CAT1, CAT2)+ 40% Minimum(CAT1, CAT2)	Final Evaluation-Theory: 100 % - 2hrs:

| **Recommended Readings** | • Boelkins,M.R,Goldberg, J. L, Potter, M. C. (2009). *Differential Equations with Linear Algebra (1st Edition).* Oxford university Press.

• Meyer, C.D. (2001). *Matrix Analysis and Applied Linear Algebra with Solutions to Problems (1st Edition).* Society for Industrial and Applied Mathematics.

• Shores, T.S. (2007). *Applied Linear Algebra and Matrix Analysis (7th Edition).* Springer International Publishing.

• Olver, P (2014). *Introduction to Partial Differential Equations (1st Edition).* Springer International Publishing.
• Greenspan, Donald (1971). *Introduction to Partial Differential Equations (1st Edition).* Tata McGraw-Hill. |