<table>
<tr><td>Course Code</td><td colspan="5">ADU5302</td></tr>
<tr><td>Level</td><td colspan="5">05</td></tr>
<tr><td>Course Title</td><td colspan="5">Mathematical Methods</td></tr>
<tr><td>Credit Value</td><td colspan="5">3</td></tr>
<tr><td>Core/Optional</td><td colspan="5">Core for Applied Mathematics as major discipline</td></tr>
<tr><td>Prerequisites</td><td colspan="5">ADU3302 (Pass/ Valid OCAM))</td></tr>
<tr><td rowspan="2">Hourly Breakdown</td><td colspan="2">Theory</td><td>Practical hours</td><td>Independent Learning</td><td>Assessments</td><td>Total hours</td></tr>
<tr><td>25×2 = 50 hours</td><td>4×3=12 hours</td><td>N/A</td><td>25×3 = 75 hours

Online learning -5

Recommended readings -6</td><td>▪ CA - 2 hours</td><td>150 hours</td></tr>
<tr><td>Course Aim/s</td><td colspan="5">This course aims at introducing students to the basic concepts and results on
1. Laplace Transforms
2. Fourier series
3. Gamma, Beta
4. Bessel
5. Legendre Functions</td></tr>
<tr><td>Programme Learning Outcomes (PLO) addressed by course</td><td colspan="5">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.</td></tr>
<tr><td>Course Learning Outcomes (CLO)</td><td colspan="5">At the completion of this course student will be able to

CLO1: define Laplace transform of a function and Calculate the Laplace transform of standard functions both from the definition and by using tables (PLO1).

CLO2: differentiate and integrate Laplace transforms of given functions, find the Laplace transforms of derivatives and integrals of given functions and use the appropriate shift theorems in finding Laplace and inverse Laplace transforms (PLO1, PLO5).

CLO3: select and combine the necessary Laplace transform techniques to solve ordinary differential equations (PLO1, PLO3, PLO5, PLO9)

CLO4: Identify the Sturm-Liouville problem and solve partial differential equations for a given Sturm-Liouville problem. (PLO1, PLO3, PLO5, PLO9)

CLO5: Define the fourier series and half-range Fourier Series, Identify the convergence of Fourier Series and operations on Fourier Series. (PLO1, PLO3, PLO5, PLO9)

CLO6: define mathematical formulations of beta and gamma functions, identify their properties and relationship between these two functions and evaluate certain integrals using gamma and beta functions (PLO1, PLO3, PLO5, PLO9)

CLO7: define the Bessel's Function, determine the orthogonality, derive the Recurrence Relations, obtain generating function and obtain the Integrals of Bessel's functions (PLO1, PLO3, PLO5, PLO9)

CLO8: define the Legendre Polynomials, obtain generating functions and determine the orthogonality of Legendre polynomials (PLO1, PLO3, PLO5, PLO9)

CLO9: solve Chebyshev equation, obtain the Chebyshev polynomial and some techniques related to Chebyshev Polynomials (PLO1, PLO3, PLO5, PLO 9)

CLO10:solve boundary value problems involving Laplace's equation by separation of variables, in cartesian, polar, spherical and cylindrical coordinates (PLO1, PLO3, PLO5, PLO9)</td></tr>
<tr><td>Content (Main topics, Sub topics)</td><td colspan="5">Laplace Transforms, Linearity and Existence, Laplace transform of the derivative of a function, Laplace Transforms of Integrals, First shift theorem or s-shift theorem, Second shift theorem, Differentiation of Laplace transforms, Integration of Laplace transforms, Inverse Laplace Transformation, Properties of Inverse Laplace Transformation, Inverse Laplace Transforms of Derivatives and Integrals, Convolution, Properties of Generalized Product, Applications of Laplace Transforms for Solving Differential, Sturm-Lowville Problems, Characteristic Values and Characteristic Functions, Orthogonality of Characteristic Functions, Expansion of a Function as a Series of Orthonormal Functions, Trigonometric Fourier series, Fourier Sine Series and Fourier Cosine Series, Convergence of Trigonometric Fourier series, Gamma Function, The Beta Function, Convergence of Trigonometric Fourier Series, Differential Equations Reducible To The Bessel's Equation, Legendre Function, Fourier – Legendre and Fourier Bessel Series, Chebyshev Polynomials, Boundary Value Problems.</td></tr>
<tr><td>Teaching – Learning methods</td><td colspan="5">Self-Learning/independent learning of Self-study
▪ Instructional Material (IL)
▪ Online Activities (OL)
▪ Reference Work (RF)</td></tr>
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<tr><td></td><td colspan="2">Compulsory contact sessions
▪ Assessments (AS) and Feedback-MCQs(MCQ); Structured Essay (SEQ); Essay Questions (ES);
Non-compulsory contact sessions
▪ Day Schools (DS)</td></tr>
<tr><td rowspan="2">Assessments Stratergy:</td><td>Overall Continuous Assessment Mark (OCAM): 40%</td><td>Final Assessment (FA): 60%</td></tr>
<tr><td>Details: Continuous Assessment1 (CAT1) :- 1hr
Continuous Assessment2 (CAT2) :- 1hr
OCAM=60%Maximum (CAT1, CAT2)+
40% Minimum(CAT1, CAT2)</td><td>Final Evaluation-Theory: 100 % - 2hrs:</td></tr>
<tr><td>Recommended Readings</td><td colspan="2">• Ram, B (2010). Engineering Mathematics III (1st Edition). Pearson Education.
• Felder, G.N, Felder (2015), K.M. Mathematical Methods in Engineering and Physics (1st Eddition). Wiley.
• Ferreira, N.M.F, Machado, J.A.T(2014). Mathematical Methods in Engineering (1st Edition). Spring Netherland.</td></tr>
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