Gyanmanjari Innovative University

Syllabus
Gyanmanjari Diploma Engineering College
Semester-3 (Diploma)

Subject: Applied Mathematics-DET2XX13110

Type of course: Major (Core)

Prerequisite: Basic algebra, Determinants, Matrices, Functions, Limits

Rationale: Applied Mathematics bridges the gap between theoretical mathematics and practical problem-solving in engineering. While reinforcing core concepts, the course introduces real-world applications in optimization, data calculation, and engineering modeling. Emphasizing conceptual clarity and analytical reasoning, students learn to solve engineering problems methodically and apply mathematics effectively in practical and industrial contexts.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
4	0	0	4	100	50	150

Course Content:

<table>
<tr><th>Sr. No</th><th>Course Content</th><th>Hrs.</th><th>% Weightage</th></tr>
<tr><td>1</td><td>Trigonometry:
Units of Angles (degree and radian) ,Trigonometric Functions ,Allied & Compound Angles, Multiple –Submultiples angles ,Graph of Sine and Cosine, Periodic Trigonometric function , Sum and factor formulae , Inverse Trigonometric function
<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>The Angular Identity Verification Challenge
An evaluating student capability in simplifying multi-angle reduction formulas and executing trigonometric factor transformations.</td><td>20</td><td></td></tr>
<tr><td>2</td><td>Assignment: The Acoustic Sine Wave Mapping
Students graph alternating voltage or sound wave cycles to see how mathematical equations look in real life.</td><td></td><td>10</td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
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Description of Assignment: The Acoustic Sine Wave Mapping (10 Marks)
Students examine how periodic trigonometric expressions represent</td><td>12</td><td>20%</td></tr>
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<table>
<tr><td></td><td>physical alternating voltage or acoustic wave cycles to see how mathematical equations look in real life. The activity includes:
• Student construction of diagrams, charts, or graphs: Plotting explicit variations of examples like, y = a sin(bx) on graph networks to visually track variations in amplitude, frequency, and period profiles.
• Analyzing system parameters: Calculating values from multi-angle or compound transforms to map wave shifts accurately.
• Preparing a structural summary: Drafting a concise narrative interpreting how numbers within a function alter real-world structural wave models.</td><td></td><td></td></tr>
<tr><td>2</td><td>Statistics :
Data Classification, Mean ,Median and Mode for ungrouped and grouped data, Mean deviation and Standard deviation for ungrouped and grouped data
<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>The Baseline Data & Deviation Formulation
Step-by-step arithmetic computation of data distributions for ungrouped and basic grouped data sets.</td><td>20</td><td></td></tr>
<tr><td>2</td><td>Group Activity: The Production Line Quality Check: Students act as quality control technicians checking for errors or variations in parts.</td><td></td><td>10</td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
</table>
Description of Group Activity: The Production Line Quality Check (10 Marks)
Students act as quality control technicians checking for errors or dimensional variations in manufactured engineering parts. The activity includes:
• Assembling distribution datasets: Organizing raw grouped and ungrouped engineering tolerance data parameters collected from an operational scenario.
• Executing statistical metrics: Running mathematical calculations step-by-step to find the precise Arithmetic Mean, Mean Deviation, and Standard Deviation of the dataset.
• Evaluating consistency benchmarks: Providing a written justification detailing whether the dataset spread indicates stability or critical production line errors.</td><td>12</td><td>20%</td></tr>
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Differential Equations :
Concept and Definition, Order and Degree of differential equation, Solution of DE of first degree and first order by Variable Separable method, Solution of linear Differential equation
<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>The Initial Value & Separable Calculation
Identifying baseline calculus properties and applying simple variable separation or linear integrating factors.</td><td>20</td><td></td></tr>
<tr><td>2</td><td>Assignment: The Rate-of-Change Solution Blueprint:
Students map out how things change over time, like a cup of hot tea cooling down or water draining out of a tank.</td><td></td><td>10</td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
</table>
Description of Assignment:: The Rate-of-Change Solution Blueprint (10 Marks)
Students map out how dynamic physical entities change over time, such as tracking a cup of hot tea cooling down or water draining out of a tank. The activity includes:

Formulating rate models: Classifying the order, degree, and initial conditions of a physical rate process.
Isolating variables systematically: Executing step-by-step calculus transitions using the Variable Separable method or linear differential equations.
Structuring an analytical schematic: Preparing a final written calculus solution blueprint used to forecast system behavior across future time horizons

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Complex Numbers :
Concept of Complex number, Algebra of Complex numbers, Conjugate, Modulus and inverse of Complex numbers, Argument and Polar form of a Complex number, De Moivre's Theorem and related simple examples, Square root of a Complex number and cube root of unity.
<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td></td><td>The Rectangular-Polar Transformation Grid
Core arithmetic operations, coordinate plotting, and basic transforms using De Moivre's Theorem.</td><td></td><td></td></tr>
<tr><td></td><td>The Step-by-Step Logic Flowchart
Students draw a visual step-by-step recipe diagram to map out the exact structural rules for converting complex rectangular forms into polar coordinates.</td><td></td><td></td></tr>
<tr><td></td><td>Total:</td><td>20</td><td>10</td></tr>
</table>
Description The Step-by-Step Logic Flowchart (10 Marks):
Students draw a visual step-by-step recipe diagram to map out the exact structural rules for converting complex rectangular forms into polar coordinates. The activity includes:

Constructing algorithmic flowcharts: Drawing sequential logic networks that map out operations from raw parameters like, (a + bi) into polar structures like, (r(cosθ + isin θ)).
Charting mathematical pathways: Correctly labeling operational processes, variable steps, and coordinate mapping bounds.
Delivering a functional breakdown: Presenting a clean, visually communicative schematic layout that guides any user through the root transformation logic without error.

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Advanced Matrix Theory: Solving small systems using Cramer's Rule and Matrix Inverse method, Elementary row and column transformations; Rank of a matrix; Consistency and Inconsistency of linear systems; Solving systems of equation using Gauss Elimination method; Characteristic equation; Eigenvalues and Eigenvectors.
<table>
<tr><th>Sr No.</th><th>Evaluation Methods</th><th>SEE</th><th>CCE</th></tr>
<tr><td>1</td><td>The Linear System Consistency Verification
Basic transformations, rank tracking, and solving system configurations using standard Cramer's or Gaussian patterns</td><td>20</td><td></td></tr>
<tr><td>2</td><td>The Formula Flash Card Drill</td><td></td><td>10</td></tr>
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<td>20%</td>
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	Students participate in a rapid mental math race to instantly calculate elementary row transformations on a matrix displayed on the board.		
	Total:	**20**	**10**

Description of The Formula Flash Card Drill (10 Marks):
Students participate in a rapid mental math race to instantly calculate elementary row transformations on a matrix displayed on the board.
The activity includes:

- **Processing visual matrix arrays:** Instantly breaking down a displayed matrix configuration into isolated row vectors.
- **Executing rapid scalar operations:** Computing quick transformations and rank values under speed-optimized classroom constraints.
- **Verifying system properties:** Confirming the step-by-step changes to help establish system consistency, characteristic equations, or Cayley-Hamilton structures.

Suggested Specification table with Marks:

Distribution of Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	10%	30%	20%	10%	20%

Course Outcomes:

After learning the course, the students should be able to:	
CO1	Apply trigonometric factor formulae, allied-angle identities, and inverse properties to model structural wave cycles and parameter shifts.
CO2	Compute arithmetic mean, mean deviation, and standard deviation tracking parameters for engineering component data sets.
CO3	Solve first-order, first-degree differential equations and linear initial value systems using variable separation and integrating factors.
CO4	Transform complex expressions between rectangular coordinates and polar structures using algebraic rules and De Moivre's Theorem.
CO5	Analyze systems of linear equations using matrix transformations, rank computations, Echelon reductions, and Eigenvalue characteristics.

Instructional Method:

The course will be delivered using traditional classroom teaching supported by active and application-based learning strategies appropriate for diploma engineering students. In addition to blackboard teaching, the instructor will use:

- **Open-book learning and guided problem-solving** for periodic calculations, baseline data distributions, and complex number transforms.
- **Worksheet-based practice** for trigonometric factor formulae, statistical deviations, first-order differential equations, and matrix row reductions.
- **Graphical and visual methods** for plotting sine/cosine waves, sketching rate-of-change models, and mapping complex coordinates on the Argand plane.
- **Group activities and interactive challenges** such as raw engineering data collections, variable separation flow-logic scaffolding, and structural matrix problem-solving sprints.
- **Active Learning Assignments (ALA)** including *The Acoustic Sine Wave Mapping*, *The Step-by-Step Logic Flowchart*, and *The Rate-of-Change Solution Blueprint*.
- **Speed-optimized drills** using matrix row operation visual aids and flashcards to build quick operational recall and reinforce mathematical consistency patterns.
- **Interactive assessments** through focused problem scripts, brief oral walkthroughs, and peer-teaching verification exercises to reinforce conceptual clarity.
- **Internal evaluation based on SEE and CCE components** as prescribed, including structured worksheets, flowchart blueprints, census reports, and performance sprints.

Reference Books:

[1]. *Advanced Engineering Mathematics*, By Erwin Kreyszig, Wiley India Pvt. Ltd.

[2]. *Calculus and Analytical Geometry*, By Thomas & Finney, Pearson / Addison-Wesley.

[3]. *Higher Engineering Mathematics*, By B. S. Grewal, Khanna Publishers, New Delhi.

[4]. *Calculus: Early Transcendentals*, By James Stewart, Cengage Learning India Pvt. Ltd.

Suggestive Assessment Guidelines:

Module 1: The Acoustic Sine Wave Mapping
10 Marks: Flawless wave graphs, perfect period calculations, and clear structural summaries.
08 Marks: Highly accurate wave charts with minor notation gaps or isolated labeling errors.
05 Marks: Basic periodic properties graphs present but show counting or coordinate overlap errors.
02 Marks: Weak, highly flawed wave sketches with limited conceptual clarity.
00 Marks: Not submitted.

Module 2: The Production Line Quality Check **10 Marks:** Perfect method selection, flawless standard deviation calculations, and strong analytical reasoning. **08 Marks:** Solid mathematical execution showing clear logic with minor isolated arithmetic mistakes. **05 Marks:** Basic frequency distribution tables are present but execution steps are left incomplete. **02 Marks:** Weak understanding of variance metrics with very limited computational explanation. **00 Marks:** Not submitted
Module 3: The Rate-of-Change Solution Blueprint **10 Marks:** Flawless classification of differential structures, perfect variable separation, and absolute calculation steps. **08 Marks:** Correct integration pathways utilized with minor isolated calculus notation gaps. **05 Marks:** Basic separation logic identified but fails to execute integration limits or complete tracking.**02 Marks:** Poorly structured math layout showing a highly limited understanding of initial value bounds. **00 Marks:** Not submitted or off-topic
Module 4: The Step-by-Step Logic Flowchart **10 Marks:** Flawless flowchart construction, perfect mathematical sequence mapping, and excellent visual organization. **08 Marks:** Correct logic diagram showing all major path blocks with minor notation omissions. **05 Marks:** Visual diagram provided but lacks clear branching steps or confuses coordinate transformation zones. **02 Marks:** Poorly structured schematic layout that fails to link conversion parameters correctly. **00 Marks:** Not submitted or off-topic.
Module 5: The Formula Flash Card Drill **10 Marks:** Exceptional mental execution speed and absolute arithmetic accuracy across all transformation rounds. **08 Marks:** High accuracy during speed transformation drills with minor isolated calculation gaps under pressure. **05 Marks:** Basic row reduction concepts understood but struggles to maintain accuracy during mental calculations. **02 Marks:** Minimal success in computing basic scalar additions or elementary row operations during drills. **00 Marks:** Not submitted.