GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma Engineering in Mechanical/Mechatronics/Automobile/Chemical/Petrochemical Technology/ Civil/ Electrical/Computer/Information Technology/Agriculture/Biomedical / Electronics & Communication		
Semester	II	Version	1.0.0.0
Effective from Academic Year	2025-26	Effective for the batch Admitted in	JULY 2025
Course Code	1BS2101	Course Name	Mathematics - II

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code and Name	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
AEC	1BS2101 Mathematics-II	3	-	-	1	4	2	40	60	100	40	-	-	-	-	20	8	120

Abbreviation:	**CL**- Classroom Learning	**TL**- Tutorial Learning	**LL**-Laboratory Learning
	SLH-Self Learning Hours	**NLH**-Notional Learning Hours	**SLA**-Self Learning Assessment
	FA-Formative Assessment (Term work +Mid Sem Exam+ Attendance) **SA**-Summative Assessment		

II. PRE-REQUISITES

- Basic Algebraic Skills
- Coordinate Geometry Fundamentals
- Functions and Graphs
- Trigonometric and Calculus Foundations
- Data Handling and Statistical Concepts

III. INDUSTRY /EMPLOYER EXPECTED OUTCOMES

- Ability to Interpret and Apply Geometrical Data
  Employers expect Diploma Student to accurately interpret and apply geometrical and spatial data—such as distances, angles, and coordinates—in design, layout planning, CAD drawings, and surveying operations.
- Capability to Analyse and Present Quantitative Data
  Diploma Student should be able to collect, summarize, and interpret numerical data using statistical tools (mean, median, mode, standard deviation) to support quality control, production optimization, and decision-making.
- Strong Foundation in Functional Relationships and Limits
  Employers value understanding of how variables interact and change, especially in process control, instrumentation, and electronics. Limits and functions are essential for modeling behaviors of circuits, sensors, and systems.
- Skill in Understanding and Applying Calculus in Engineering Problems
  Engineering industries (especially mechanical and electrical) expect to apply derivatives for solving real-world problems like motion analysis, optimization, and control systems.
- Ability to Estimate and Compute Areas, Volumes, and Accumulated Quantities
  Diploma Student should be able to apply integration in tasks like calculating material requirements, areas under curves, or energy consumption over time, which is critical in civil, mechanical, and automation-related roles.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Analyse geometric problems involving points, straight lines, and circles using coordinate geometry, and apply these concepts to solve engineering problems.

CO2. Analyse and interpret engineering data using statistical measures of central tendency (mean, median, mode) and dispersion (range, variance, standard deviation), with applications in quality control, manufacturing processes, and reliability testing.

CO3. Understand and evaluate functions and limits, applying these concepts to model and solve real-world engineering problems.

CO4. Apply differentiation techniques to solve problems related to rates of change, optimization, and curve sketching.

CO5. Use integration methods to calculate areas, volumes, and other quantities in engineering contexts, and apply integrals to solve problems related to engineering.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's)&CO's	Marks	Hours
Unit-1 Co-ordinate Geometry	**TLO1.1** Define coordinate axes and determine coordinates of a point in Cartesian plane. **TLO1.2** Calculate the distance between two points using the distance formula. **TLO1.3** Determine the midpoint of a line segment joining two points. **TLO1.4** Calculate the area of a triangle formed by three given points. **TLO1.5** Identify different forms of straight-line equations (slope-intercept, point-slope, etc.). **TLO1.6** Find the slope and intercepts of a line and interpret their geometric meaning. **TLO1.7** Determine conditions for lines to be parallel or perpendicular based on their slopes. **TLO1.8** Derive and apply the general and standard equation of a circle. **TLO1.9** Find the tangent and normal to a circle at a given point and solve related problems.	**1.1** Introduction to Cartesian coordinate system; plotting points **1.2** Derivation and application of the distance formula between two points **1.3** Midpoint formula and its use in geometry and engineering contexts **1.4** Area of a triangle using determinant method or coordinate formula **1.5** Forms of straight-line equations: slope-intercept, point-slope, two-point, and general form **1.6** Finding slope and intercepts from line equations; interpretation in physical contexts **1.7** Conditions for parallelism and perpendicularity of lines based on slope comparisons **1.8** Equation of a circle: general and standard forms; identifying center and radius **1.9** Tangent and normal to a circle; geometrical meaning and problem-solving using derivatives or geometry methods	**12**	**9**
Unit-2 Statistics	**TLO2.1** Define statistics and explain its importance in engineering and data analysis. **TLO2.2** Differentiate between ungrouped and grouped data.	**2.1** Introduction to statistics and its role in engineering applications **2.2** Types of data: Ungrouped vs Grouped, data classification and tabulation	**14**	**10**

	TLO2.3 Calculate the arithmetic mean for ungrouped data using direct and shortcut methods.	**2.3** Methods to calculate mean for ungrouped data; formulas and examples		
	TLO2.4 Calculate the arithmetic mean for grouped data using frequency distribution. **TLO2.5** Determine the median for ungrouped and grouped data using appropriate formulas. **TLO2.6** Determine the mode for ungrouped and grouped data, including the use of the empirical formula. **TLO2.7** Interpret and compare central tendency measures (mean, median, mode) in the context of engineering data. **TLO2.8** Explain the concept of dispersion and its significance in quality control and process stability. **TLO2.9** Compute standard deviation for ungrouped and grouped data using step-deviation and direct methods. **TLO2.10** Analyse the variability in engineering data sets using mean and standard deviation for decision making.	**2.4** Calculation of mean for grouped data: direct, assumed mean and step-deviation methods **2.5** Procedure to find median for ungrouped and grouped data using class intervals **2.6** Computation of mode for both ungrouped and grouped data with empirical relation **2.7** Comparative analysis of mean, median and mode; choosing appropriate central measure **2.8** Meaning and significance of dispersion in process performance and reliability **2.9** Step-by-step method for calculating standard deviation (grouped & ungrouped data) **2.10 Case**-based application of mean and standard deviation in quality control and engineering processes		
Unit-3 Function & Limit	**TLO3.1** Define a function and distinguish between different types of functions (linear, quadratic, etc.). **TLO3.2** Interpret function notation and evaluate functions for given inputs. **TLO3.3** Describe the concept of a limit and explain its significance in mathematics and engineering. **TLO3.4** Apply standard limit formulas (e.g., lim $x \to a$ (x^n), lim $x \to 0$ (sin x)/x, etc.) to evaluate simple limits. **TLO3.5** Solve numerical problems involving limits using substitution and algebraic simplification. **TLO3.6** Apply the concept of limits in real-world engineering problems, such as continuity and rate of change scenarios.	**3.1** Introduction to functions; definition and classification of different types (e.g., linear, polynomial) **3.2** Function notation, domain and range, and evaluation of functions **3.3** Basic concept and intuitive idea of a limit with graphical and numerical illustrations **3.4** Use of standard limit formulas for solving basic problems **3.5** Algebraic methods (factoring, rationalization) for evaluating limits **3.6** Application of limits in simple engineering contexts such as motion, flow, and design continuity	**8**	**6**
Unit-4	**TLO4.1** Define differentiation and understand its significance in engineering and science.	**4.1** Introduction to differentiation and its engineering relevance	**14**	**11**

Differentiation & it's Applications	**TLO4.2** Use basic formulas for the derivatives of algebraic, trigonometric, exponential, and logarithmic functions.	**4.2** Standard derivatives of x^n, sin x, cos x, e^x, ln x, and related basic formulas		
	TLO4.3 Apply the rule of sum and difference of functions to compute derivatives. **TLO4.4** Apply the product rule of differentiation to solve relevant problems. **TLO4.5** Use the quotient rule to differentiate functions involving division. **TLO4.6** Apply the chain rule to compute the derivative of composite functions. **TLO4.7** Differentiate implicit functions using implicit differentiation techniques. **TLO4.8** Find the derivative of parametric functions with respect to independent variable. **TLO4.9** Use logarithmic differentiation to differentiate complex expressions. **TLO4.10** Understand and apply successive differentiation for higher-order derivatives. **TLO4.11** Apply differentiation to compute velocity and acceleration in motion-related engineering problems.	**4.3** Sum and difference rule with examples **4.4** Product rule: formula, derivation, and examples **4.5** Quotient rule: definition, formula, and practice problems **4.6** Chain rule: step-by-step application in nested functions **4.7** Implicit differentiation techniques and practice with related functions **4.8** Differentiation of parametric equations (e.g., x = f(t), y = g(t)) **4.9** Logarithmic differentiation to simplify and differentiate complex expressions **4.10** Successive differentiation and computation of second-order and higher derivatives **4.11** Applications of derivatives: velocity and acceleration in straight-line motion		
Unit-5 Integration & its application	**TLO5.1** Define integration and explain its significance as the reverse process of differentiation. **TLO5.2** Evaluate basic integrals using standard formulas involving algebraic, trigonometric, exponential, and logarithmic functions. **TLO5.3** Apply the working rules of integration including constant multiplication and sum/difference of functions. **TLO5.4** Use integration by parts to evaluate integrals involving products of functions. **TLO5.5** Apply substitution method to simplify and evaluate complex integrals. **TLO5.6** Use partial fraction decomposition to integrate rational algebraic expressions. **TLO5.7** Understand and apply definite integral properties to	**5.1** Introduction to integration as the inverse of differentiation **5.2** Standard integration formulas ($\int x^n dx$, $\int e^x dx$, $\int \sin x\, dx$, $\int \ln x\, dx$, etc.) **5.3** Basic rules of integration: linearity, sum and difference rules **5.4** Integration by parts method: $\int u \cdot v\, dx$ with stepwise practice **5.5** Integration by substitution: simplifying complex integrals using variable change **5.6** Integration using partial fractions for rational algebraic expressions **5.7** Concept of definite integral, evaluation and properties	**12**	**9**

	evaluate integrals within specified limits.			
	TLO5.8 Apply definite integrals to find the area under a curve and between two curves. **TLO5.9** Solve engineering-related problems involving area using integration techniques.	**5.8** Finding area under curves and between curves using definite integration **5.9** Application-based problems in engineering involving area calculations using integration		

VI. SUGGESTED MICRO PROJECT/ASSIGNMENTS/ACTIVITIES FOR SELF LEARNING/SKILL DEVELOPMENT (SELF LEARNING)

1: Engineering Design Using Coordinate Geometry and Functions

Topics Covered: Coordinate Geometry + Function & Limit
Activity Title: "Design a Mini City Map with Mathematical Modeling"

- Draw a scaled coordinate map of a layout (campus, city block, etc.).
- Mark key locations (points), calculate distances, midpoints, area of triangle plots.
- Use straight-line and circle equations to represent roads and roundabouts.
- Model traffic flow or elevation using simple functions and explore limits (e.g., speed approaching a junction).

2: Survey and Data Analysis with Interpretation

Topics Covered: Statistics + Function
Activity Title: "Conduct and Analyze a Real-World Survey"

- Conduct a survey (e.g., daily screen time, commute time, or electricity usage).
- Organize the data as grouped/ungrouped sets.
- Calculate Mean, Median, Mode, and Standard Deviation.
- Fit a basic function to model the trend (e.g., linear increase in electricity use vs. family size).

3: Motion and Measurement Using Differentiation

Topics Covered: Differentiation & Its Applications + Function
Activity Title: "Analyze Motion Using Calculus"

- Assume a position-time function for a vehicle or object in motion.
- Differentiate to find velocity and acceleration.
- Sketch graphs for s(t), v(t), and a(t).
- Identify points of rest, maximum speed, and acceleration trends.

4: Area Estimation from Graphs and Integration

Topics Covered: Integration + Differentiation
Activity Title: "Find Area Under a Curve in Practical Scenarios"

- Choose a curve (e.g., stress-strain, speed-time).
- Use definite integrals to calculate area under the curve.

- Relate the result to a real quantity (e.g., work done, distance travelled).
- Optionally, differentiate the function first to verify concavity or rate of change.

5: Digital Tools & Visualization Project

Topics Covered: All Topics via Technology Tools
Activity Title: "Explore Math Concepts Using GeoGebra or Desmos"
Task Highlights:

- Use GeoGebra/Desmos/Excel to visualize:
  - Coordinate geometry (lines, circles, triangle area)
  - Graphs of functions
  - Limits near asymptotes
  - Derivatives as slopes
  - Area under curves
- Prepare screenshots and explanations of observations

VII. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	Diploma Engineering Mathematics – Volume II	H. K. Dass	S. Chand Publications
2	Engineering Mathematics (Semester-II for Diploma Students)	P. N. Wartikar and J. N. Wartikar	Pune Vidyarthi Griha Prakashan
3	Mathematics for Polytechnic Students (Vol-2)	R.S. Aggarwal	S. Chand
4	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers
5	Applied Mathematics for Polytechnic Students	N. P. Bali and Manish Goyal	Laxmi Publications

VIII. LINK OF LEARNING WEB RESOURCE

1	https://youtu.be/isTW-lEljW0?si=gi3exFvAeMhauPfB
2	https://youtu.be/LOSso73xSs0?si=1IGwl8BRRfqFA3_k
3	https://www.youtube.com/watch?v=04WUs_lJ4Z8
4	https://youtu.be/TMbVdc1NGlc?si=2mTZUJR9K1cUMjPR
5	https://quickmath.com/webMathematica3/quickmath/matrices/determinant/basic.jsp#

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Co-ordinate Geometry	CO1	9	2	4	6	12
2	Statistics	CO2	10	3	4	7	14
3	Function & Limit	CO3	6	2	3	3	8
4	Differentiation & it's Applications	CO4	11	2	4	8	14
5	Integration & it's Applications	CO5	9	2	4	6	12
	Grand Total		45	11	19	30	60

X. COs AND POs AND PSOs MAPPING										
Course outcome (Cos)	**Programme Outcomes (POs)**							**Programme Specific Outcomes (PSOs)**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	0	0	0	1			
CO2	3	3	2	0	1	1	1			
CO3	3	2	1	0	0	0	2			
CO4	3	3	2	1	0	1	2			
CO5	3	3	2	1	0	1	2			
Legends: - *3- High* *2-Moderate/Medium* *1-Slight/Low* *0-None*										