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Advanced Engineering Mathematics — Complete Syllabus

BTEUP Diploma in Mechanical Engineering (Production) • 6th Semester • Session 2026–27

Subject 6.3.1 (Theory) • Elective Pathway • Total 100 Marks • 3 Credits

About this document: Advanced Engineering Mathematics is subject 6.3.1 of the 6th semester of the Diploma in Mechanical Engineering (Production). It is one of the five Elective Pathway options — a student picks any ONE of the five: Advanced Engineering Mathematics (6.3.1), Additive Manufacturing (6.3.2), Project Management (6.3.3), Finance Fundamentals (6.3.4) and Industry 4.0 (6.3.5). This document gives the complete unit-wise syllabus, the examination scheme and the reference books from the official curriculum.

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Examination Scheme

Code	Paper	Type	L – P	Credits	Internal	External	Total
6.3.1	Advanced Engineering Mathematics	Theory	3 – 0	3	Theory 40	Theory 60 (3 hrs)	100
Advanced Engineering Mathematics Total				**3**	**40**	**60**	**100**

What This Subject Aims To Do

To bridge the gap between diploma mathematics and B.E./B.Tech. mathematics — matrices and eigenvalues, functions of several variables, vector calculus, differential equations and Laplace transforms — so that students can use these tools in core engineering subjects.

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Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks
1	Eigen Values and Eigen Vectors	8	12
2	Functions of Several Variables	8	12
3	Vector Calculus	8	12
4	Differential Equations	8	12
5	Laplace Transforms	10	12

Total: 42 periods, 60 marks (external theory). Each of the five units carries 12 marks in the external theory paper, as per the suggested distribution of marks in the official syllabus.

Unit 1 — Eigen Values and Eigen Vectors (8 Periods, 12 Marks)

Topics: Characteristic equation, eigen-values of 2 × 2 and 3 × 3 real matrices, eigen-vectors of 2 × 2 real matrices, properties of eigen-values (excluding proof), Cayley-Hamilton theorem (excluding proof), simple problems.

In simple words: The numbers and directions that describe a matrix — eigenvalues and eigenvectors — and the Cayley-Hamilton theorem that lets a matrix satisfy its own characteristic equation.

Unit 2 — Functions of Several Variables (8 Periods, 12 Marks)

Topics: Partial derivatives of two variable and three variable functions (up to second order), homogeneous functions and Euler's theorem (excluding proof), Jacobian matrix and determinant, maxima and minima of functions of two variables, simple problems.

In simple words: How functions of two or three variables change — partial derivatives, Euler's theorem, Jacobians — and how to find their maxima and minima.

Unit 3 — Vector Calculus (8 Periods, 12 Marks)

Topics: Scalar field and vector field, vector differential operator, gradient of a scalar field, directional derivative, divergence and curl of a vector field (excluding properties), solenoidal and irrotational vector fields, simple problems.

In simple words: The calculus of fields: gradient, divergence and curl, and what solenoidal and irrotational fields mean.

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Unit 4 — Differential Equations (8 Periods, 12 Marks)

Topics: Differential equation, formation, order and degree, solution of a differential equation, equations of first order and first degree, variable separable method, Leibniz's linear equations, second order equations of the form $(aD^2 + bD + c)y = e^{(nx)}$ with the auxiliary equation $am^2 + bm + c = 0$ having only real roots, complementary function, particular integral, general solution, simple problems.

In simple words: How to form and solve first- and second-order differential equations, including the complementary function and particular integral.

Unit 5 — Laplace Transforms (10 Periods, 12 Marks)

Topics: Definition of Laplace transform, Laplace transforms of standard functions, linearity and change of scale property (excluding proofs), first shifting property, Laplace transforms of derivatives, properties (excluding proofs), inverse Laplace transforms, properties (excluding proofs), solving first order ordinary differential equations using Laplace transforms, simple problems.

In simple words: How the Laplace transform turns a differential equation into algebra, and how to solve first-order equations with it.

Learning Outcomes

- Compute eigenvalues and eigenvectors of matrices and apply Cayley-Hamilton theorem to solve engineering problems.
- Apply partial differentiation techniques, Jacobians and optimization methods to functions of several variables.
- Analyze scalar and vector fields using gradient, divergence, and curl in engineering applications.
- Formulate and solve ordinary differential equations of first and second order arising in engineering systems.
- Apply Laplace transform techniques to solve differential equations and analyze dynamic systems.

Reference Books (as listed in the syllabus)

- John Bird, Higher Engineering Mathematics, Routledge, 9th Edition, 2021.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
- S. Arumugam, A. Thangapandi Isaac, & A. Somasundaram, Differential Equations and Applications, Yes Dee Publishing Pvt. Ltd., 2020.
- P. Duraipandian & Kayalal Pachaiyappa, Vector Analysis, S. Chand and Company Limited, 2014.

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Source: IRDT Kanpur NEP-2020 curriculum for the Diploma in Mechanical Engineering (Production), updated and approved by the Board of Technical Education, U.P., Lucknow, in the C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-language summaries, not syllabus text. Please confirm with your own polytechnic for any local changes.

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