

2.1 APPLIED MATHEMATICS - II

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RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus, Integral calculus and Differential Equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- CO1: Formulate the engineering problems into mathematical format with the use of differential equations and differential
- CO2: Use the differentiation and Integration in solving various Mathematical and Engineering problems.
- CO3: Calculate the approximate area under a curve by applying integration and numerical methods.
- CO4: Discuss the purposes of measures of central tendency and calculate the measures of central tendency (mode, median, mean) for a set of data.
- CO5: Learn about basic fundamentals about MATLAB/ SciLab and mathematical calculation with MATLAB/ SciLab software.

DETAILED CONTENTS

UNIT I

Differential Calculus

- 1.1 Definition of function; Concept of limits (Introduction only) and problems related to four standard limits only.
- 1.2 Differentiation of x^n , $\sin x$, $\cos x$, e^x by first principle.
- 1.3 Differentiation of sum, product and quotient of functions.

UNIT II

Differential Calculus and Its Applications

- 2.1 Differentiation of trigonometric functions, inverse trigonometric functions. Logarithmic differentiation, successive differentiation (upto 2nd order)
- 2.2 Application of differential calculus in:
 - (a) Rate measures
 - (b) Maxima and minima

UNIT III**Integral Calculus**

- 3.1 Integration as inverse operation of differentiation with simple examples.
- 3.2 Simple standard integrals and related problems, Integration by Substitution method and Integration by parts.
- 3.3 Evaluation of definite integrals with given limits.

$$\text{Evaluation of } \int_0^{\pi/2} \sin^n x \, dx, \quad \int_0^{\pi/2} \cos^n x \, dx, \quad \int_0^{\pi/2} \sin^m x \cos^n x \, dx$$

using formulae without proof (m and n being positive integers only) using pre-existing mathematical models.

UNIT IV**Application of Integration, Numerical Integration and Differential Equations**

- 4.1 Applications of integration: for evaluation of area under a curve and axes (Simple problems).
- 4.2 Numerical integration by Trapezoidal Rule and Simpson's $1/3^{\text{rd}}$ Rule using pre-existing mathematical models.

Differential Equations

- 4.3 Definition, order, degree, Type of differential Equations, linearity, Formulation of ordinary differential equation (up to 1^{st} order), solution of ODE (1^{st} order) by variable separation method.

UNIT V**Statistics and Software****Statistics**

- 5.1 Measures of Central Tendency: Mean, Median, Mode
- 5.2 Measures of Dispersion: Mean deviation, Standard deviation

Software

- 5.3 SciLab software – Theoretical Introduction.
- 5.4 Basic difference between MATLAB and SciLab software,
- 5.5 Calculations with MATLAB or SciLab - (a) Representation of matrix (2×2 order),
(b) Addition, Subtraction of matrices (2×2 order) in MATLAB or SciLab

RECOMMENDED BOOKS

- 1 R. D. Sharma, “Applied Mathematics – I & II for Diploma Courses”, Dhanpat Rai Publications.
- 2 “Mathematics for Class XI”, NCERT Publication, New Delhi.
- 3 “Mathematics for Class XII”, NCERT Publication, New Delhi.

- 4 H. K Dass, “Applied Mathematics for Polytechnics”, CBS Publishers & Distributors.
- 5 A Ganesh and G Balasubramanian, “Textbook of Engineering Mathematics –I”, CBS Publisher, New Delhi.
- 6 A Ganesh and G Balasubramanian, “Textbook of Engineering Mathematics –II”, CBS Publisher, New Delhi.
- 7 G. B. Thomas, R. L. Finney, “Calculus and Analytic Geometry”, Addison Wesley, Ninth Edition.
- 8 B S Grewal, “Elementary Engineering Mathematics”, Khanna Publishers, Delhi, Thirty-fifth Edition.
- 9 R.K. Jain and S.R.K. Iyengar, “Advanced Engineering Mathematics” Narosa Publishing House, New Delhi, Second Edition, 2003.
- 10 SS Sabharwal & Dr Sunita Jain, “Applied Mathematics Vol. I & II”, Eagle Parkashan, Jalandhar.
- 11 S Kohli, “Engineering Mathematics Vol. I & II”, IPH, Jalandhar.
- 12 Reena Garg & Chandrika Prasad, “Advanced Engineering Mathematics”, Khanna Publishing House, New Delhi.
- 13 R. Pratap, “Getting Started with MATLAB 7”, Oxford University Press, Seventh Edition.
- 14 E-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

- 1) <https://www.scilab.org>
- 2) <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

This is theoretical subject and contains five units of 20% equal weight age.

Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics that the industry requires. For example they need to know how to use mathematical models that use integration as opposed to learning how integration can be used. Useful authenticated software MATLAB or open source software SciLab can be taught theoretically by books/online literatures and basic operations can be shown practically with practical software laboratory or small mobile apps of these software or authentic Trial version of MATLAB/ SciLab software. Diploma students need to know which tools to use and how to do the job.