MATHEMATICS-II

Garima Singh

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FOREWORD

Engineering has played a very significant role in the progress and expansion of mankind and society for centuries. Engineering ideas that originated in the Indian subcontinent have had a thoughtful impact on the world.

All India Council for Technical Education (AICTE) had always been at the forefront of assisting Technical students in every possible manner since its inception in 1987. The goal of AICTE has been to promote quality Technical Education and thereby take the industry to a greater heights and ultimately turn our dear motherland India into a Modern Developed Nation. It will not be inept to mention here that Engineers are the backbone of the modern society - better the engineers, better the industry, and better the industry, better the country.

NEP 2020 envisages education in regional languages to all, thereby ensuring that each and every student becomes capable and competent enough and is in a position to contribute towards the national growth and development.

One of the spheres where AICTE had been relentlessly working from last few years was to provide high-quality moderately priced books of International standard prepared in various regional languages to all it's Engineering students. These books are not only prepared keeping in mind it's easy language, real life examples, rich contents and but also the industry needs in this everyday changing world. These books are as per AICTE Model Curriculum of Engineering & Technology – 2018.

Eminent Professors from all over India with great knowledge and experience have written these books for the benefit of academic fraternity. AICTE is confident that these books with their rich contents will help technical students master the subjects with greater ease and quality.

AICTE appreciates the hard work of the original authors, coordinators and the translators for their endeavour in making these Engineering subjects more lucid.

(**Anil D. Sahasrabudhe**)

Acknowledgement

The author is grateful to AICTE for their meticulous planning and execution to publish the technical book for Diploma students.

I sincerely acknowledge the valuable contributions of the reviewer of the book Prof. Billu Ram Saini, for making it students' friendly and giving a better shape in an artistic manner.

This book is an outcome of various suggestions of AICTE members, experts and authors who shared their opinion and thoughts to further develop the engineering education in our country.

It is also with great honour that I state that this book is aligned to the AICTE Model Curriculum and in line with the guidelines of National Education Policy (NEP) -2020. Towards promoting education in regional languages, this book is being translated in scheduled Indian regional languages.

Acknowledgements are due to the contributors and different workers in this field whose published books, review articles, papers, photographs, footnotes, references and other valuable information enriched us at the time of writing the book.

Finally, I like to express my sincere thanks to the publishing house, M/s. Khanna Book Publishing Company Private Limited, New Delhi, whose entire team was always ready to cooperate on all the aspects of publishing to make it a wonderful experience.

Garima Singh

Preface

Mathematics is inextricably woven to all the technological aspects of human kind. An in-depth knowledge of mathematics is of paramount importance when a student enters the world of technology. When applied to technology, it allows scientists and engineers to produce systematic, reproducible, and transmittable knowledge.

The book "Mathematics-II" is primarily designed for the students of diploma engineering(common to all branches) to tackle the 21st century and onward technological challenges. It is strictly aligned to the AICTE's model curriculum for diploma courses in engineering and technology, incorporating student's oriented and self-learning activities as per New National Education Policy 2020. Outcome Based Education and Bloom's Taxonomy concepts are the central ideas behind the book's layout. Each topic in the book has been treated in a lucid and easy style so as to make the mathematical language simple and crisp. There has been a deliberate attempt to keep the number of pages in the book minimum without compromising with the matter. While preparing the manuscript, various standard textbooks, reference books (a few mentioned in the reference section too) has been referred and accordingly the sections have been developed. Efforts have been made to explain the fundamental concepts of the subject in the simplest possible way so as to make learning a pleasure.

This book comprises of five units. There is a uniformity maintained in writing all the units. Each unit starts with the unit specifics, rationale and pre-requisites. Apart from the theory explanation and solved examples, mini-projects, activity, fun-facts, QR codes, case studies, video resources, real life applications have been incorporated so as to enhance interactive understanding and student's applicability skills,which make them competitive and employable. Check-out section has been introduced so as to activate the curiosity part of the student by corelating all the topics studied in this book with MATLAB. The text has been supplemented with notes, remarks, remember sections within grey boxes. In addition, some useful information has been given under the heading 'Know More'. Relevant essential basic information has been incorporated in the Appendices. An attempt has been made to enrich the book by including a few activities in the Annexures part. Overall, an approach has been tried to made so as to discourage rote memorization. For direct recapitulation of main concepts, formulae and results, brief summary of the unit has been given.

At the end of each unit ,an excerpt related to eminent Indian Mathematicians is given so as to make students have a glimpse of the rich Indian heritage, especially in the field of mathematics.

I sincerely hope that the book will motivate and inspire students to learn and apply basics of mathematics and will definitely contribute towards solid foundation building of the subject. I would be grateful to acknowledge any comments/suggestions from the teachers/students/readers towards further improvement of the book in future editions. It was indeed a pleasure writing the book covering varied topics in a crisp manner for future leaders to make fundamental contributions towards society.

Garima Singh

Outcome Based Education

For the implementation of an outcome based education the first requirement is to develop an outcome based curriculum and incorporate an outcome based assessment in the education system. By going through outcome based assessments, evaluators will be able to evaluate whether the students have achieved the outlined standard, specific and measurable outcomes. With the proper incorporation of outcome based education there will be a definite commitment to achieve a minimum standard for all learners without giving up at any level. At the end of the programme running with the aid of outcome based education, a student will be able to arrive at the following outcomes:

Programme Outcomes (POs) are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability attitude and behaviour that students acquire through the program. The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

National Board of Accreditation (NBA) has defined the following seven POs for an Engineering diploma graduate:

PO1. Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO2. Problem analysis: Identify and analyses well-defined engineering problems using codified standard methods.

PO3. Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4. Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5. Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7. Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

Course Outcomes

By the end of the course the students are expected to learn:

CO-1: The necessary background in matrices and determinants so as to apply them in finding solutions and aid in interpreting/analysing linear systems, optimization tactics.

CO-2: Determining the area and volume especially by applying simple techniques of Integral calculus.

CO-3: To analyse that coordinate geometry provides a connection between algebra and geometry through graphs of lines and curves.

CO-4: To tell the difference between a resultant and a concurrent force; to interpret and analyse simple physical problems in the form of a differential equation.

CO-5: To explore and visualize data by using the applicability of topics learnt and also with the help of some basics of MATLAB.

Mapping of Course Outcomes with Programme Outcomes to be done according to the matrix given below:

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)						
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7
CO-1	3	3	3	3	1	1	3
CO-2	3	2	2	2	1	1	3
CO-3	3	2	2	2	1	1	3
CO-4	3	2	2	3	1	1	3
CO-5	3	3	3	3	1	1	3

Symbols and Abbreviations

Symbol/ Abbreviation	Name of Sign/Full form	Symbol/ Abbreviation	Name of Sign/Full form
[A:B] or [A/B]	Augmented matrix	$\frac{dy}{dx}$	Differential operator of variable y w.r.t. variable x
$\overline{AB}$	Line segment AB	$\int$	Integral
$\lvert AB \rvert$	The length of $\overline{AB}$	!	Factorial
$\overrightarrow{AB}$	Ray AB	$\in$	Is an element of/belongs to
CO	Course outcomes	$\notin$	Is not an element of/does not belong to
UO	Unit outcomes	$\neq$	Is not equal to
PO	Programme outcomes	$\sim$	Is similar to
N	Set of natural numbers	$\|\|$	Is parallel to
W	Set of whole numbers	$\approx$	Is approximately equal to
Z	Set of integers	( )	Parentheses (grouping symbol)
Q	Set of rational numbers	[ ]	Square brackets (grouping symbol)
R	Set of real numbers	{ }	Brace or curly brackets (grouping symbol)
C	Set of complex numbers	$\cong$	Is congruent to
I	Set of irrational numbers	$\sqrt[3]{\ }$	Cube root
Lf′ (a)	Left hand derivative of ‘f’ at ‘a’	Σ	The sum of
Rf′ (a)	Right hand derivative of ‘f’ at ‘a’	$\subset$ or $\subseteq$	Is a sub set of
L.H.S.	Left hand side	$\not\subset$ or $\not\subseteq$	Is not a subset
R.H.S.	Right hand side	$\cup$	Union of
adj (A)	Adjoint of matrix A	$\cap$	The intersection of
lim	Limit	ϕ	Empty set/null set
$f^n(a)$	n^{th} derivative of (f) at ‘a’	$\Rightarrow$	This implies
s.t.	Such that	$\Leftrightarrow$	Implies and is implied by
w.r.t.	With respect to	$\lvert\ \rvert$	Modulus
$\forall$	For all	$\therefore$	Therefore
$\lVert\ \rVert$	Norm	$\because$	Because

List of Figures

Unit 1: Determinants and Matrices

Unit 2: Integral Calculus

Unit 3: Co-ordinate Geometry

Unit 4: Vector Algebra

Unit 5: Differential Equations

The implementation of Outcome Based Education (OBE) framework and enhanced focus on the use of

Guidelines for Teachers

Bloom's Taxonomy necessitates that knowledge level and professional skills of the students should be enhanced. Teachers should take a major responsibility for the proper implementation of OBE. Some of the responsibilities (not limited to) for the teachers in OBE system may be as follows:

- Within reasonable constraint, they should manipulate time to the best advantage of all students.
- They should assess the students only upon certain defined criterion without considering any other potential ineligibility to discriminate them.
- They should try to grow the learning abilities of the students to a certain level before they leave the institute.
- They should try to ensure that all the students are equipped with the quality knowledge as well as competence after they finish their education.
- They should always encourage the students to develop their ultimate performance capabilities.
- They should facilitate and encourage group work and team work to consolidate newer approach.
- They should follow Blooms taxonomy in every part of the assessment.

Bloom's Taxonomy

Level	Teacher should Check	Student should be able to	Possible Mode of Assessment
Creating	Students ability to create	Design or Create	Mini project
Evaluating	Students ability to Justify/evaluate	Explain or Defend	Assignment
Analysing	Students ability to Scrutinize	Differentiate or examine	Project Methodology/Case Study
Applying	Students ability to use information	Solve or implement	Presentation/ Demonstration of solution of real life problems
Understanding	Students ability to explain the ideas	Explain or Classify	Presentation/Seminar
Remembering	Students ability to recall (or remember)	Define or Recall	Quiz

Guidelines for Students

Students should take equal responsibility for implementing the OBE. Some of the responsibilities (not limited to) for the students in OBE system are as follows:

- Students should be well aware of each UO before the start of a unit in each and every course.
- Students should be well aware of each CO before the start of the course.
- Students should be well aware of each PO before the start of the programme.
- Students should think critically and reasonably with proper reflection and action.
- Learning of the students should be connected and integrated with practical and real-life consequences.
- Students should be well aware of their competency at every level of OBE.

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