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Basic Mathematics

(BMS-22103)

For

First Year Diploma Course in Engineering

(Common for all branches)

SEMESTER – I

Dr. S. P. Pawar *M.Sc., Ph.D. (Mathematics)* Head Dept. of Applied Sciences S.S.V.P.Sanstha's. Bapusaheb Shivajirao Deore Polytechnic, Dhule. 'I' Scheme Committee Member	***Prof. H. D. Jadhav*** M.Sc., M.Phil. (Mathematics) Head Dept. of Applied Sciences Govt. Polytechnic, Miraj 'I' Scheme Committee Member
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Ph: 952 952 0952 **E-mail : info.gigatech1@gmail.com**

Dedicated to

My beloved Father

Late

Appasaheb

Pandurang B. Pawar

&

My Mother

Late

Taisaheb

Venubai Pawar

who was the source of

my inspiration.

IMPORTANCE OF MATHEMATICS

- Mathematics is very important in our daily life. It finds application in various types of professions.
- Mathematics is the language used in the understanding and deliverance of scientific notions.
- Mathematics has a vital role in the engineering education.
- Mathematics equips pupils with uniquely powerful ways to describe, analyze and change the world.
- Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the workplace, business and finance; and for personal decision-making.
- Generality and interconnection between subjects which can only be made possible by the marriage between mathematics and engineering knowledge.
- For the common man, knowledge of mathematics helps him in his personal development and enhancing his mental abilities.
- Engineering is one of the most important professions for the mathematics discipline.
- Engineering is a quantitative discipline, traditionally strongly based on mathematics.

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Preface

With a great pleasure and satisfaction, we present the text book of ***'Basic Mathematics'*** *for the new curriculum (Semester pattern) ' I ' scheme with effect from the academic year 2017-18 for First Year Diploma Course in 'Engineering and Technology' (Semester-I). In presenting this* ***First Revised Edition****, an utmost care has been taken to make the contents precise, simple and perfect. From our long experience, we have constantly kept in mind the requirements of the common student for understanding the subject Mathematics, as related to the technology. Hence, the contents are presented in very simple & easy language. The special feature is that we have included lot of exercises at the end of each chapter with answers, which will certainly help to understand the subject.*

*We are very thankful to Shri. Harshal Potdar & Shri. Dnyaneshwar Nagare and staff members of " **Gigatech Publishing House, Pune**" for their encouragement and co-operation to write this text book.*

We are also thankful to Shri. Kaustubh S. Pawar who has taken untiring wholeheartedly efforts and gave innumerable suggestions to make the book effective especially for common students coming from the rural areas.

In spite of our best efforts to make the book unique and complete, it may have some shortcomings. From bottom of our heart we earnestly and sincerely request the Students, Professors and other Readers to inform us any discrepancies observed in this book on the following e-mail address which may be incorporated in the next edition.

Dr. S. P. Pawar
sppawar17@yahoo.co.in

Prof. H. D. Jadhav
j.hindurao@yahoo.com

SYLLABUS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I Algebra	1a. Solve the given simple problem based on laws of logarithm. 1b. Calculate the area of the given triangle by determinant method. 1c. Solve given system of linear equations using matrix inversion method and by Cramer's rule. 1d. Obtain the proper and improper partial fraction for the given simple rational function.	1.1 Logarithm: Concept and laws of logarithm 1.2 Determinant and matrices a. Value of determinant of order 3x3 b. Solutions of simultaneous equations in three unknowns by Cramer's rule. c. Matrices, algebra of matrices, transpose adjoint and inverse of matrices. Solution of simultaneous equations by matrix inversion method. d. Types of partial fraction based on nature of factors and related problems.
Unit– II Trigonometry	2a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). 2b. Apply the concept of Sub-multiple angle to solve the given simple engineering related problem(s) 2c. Employ concept of factorization and de-factorization formulae to solve the given simple engineering problem(s) 2d. Investigate given simple problems utilizing inverse trigonometric ratios.	2.1 Trigonometric ratios of Compound, allied, multiple and sub-multiple angles (without proofs) 2.2 Factorization and de-factorization formulae(without proofs) 2.3 Inverse trigonometric ratios and related problem. 2.4 Principle values and relation between trigonometric and inverse trigonometric ratio.

Unit– III Coordinate Geometry	3a. Calculate angle between given two straight lines 3b. Formulate equation of straight lines related to given engineering problems. 3c. Identify perpendicular distance from the given point to the line. 3d. Calculate perpendicular distance between the given two parallel lines.	3.1 Straight line and slope of straight line a. Angle between two lines. b. Condition of parallel and perpendicular lines. 3.2 Various forms of straight lines. a. Slope point form, two point form. b. Two points intercept form. c. General form. d. Perpendicular distance from a point on the line. e. Perpendicular distance between two parallel lines.
Unit-IV Mensuration	4a. Calculate the area of given triangle and circle. 4b. Determine the area of the given square, parallelogram, rhombus and trapezium. 4c. Compute surface area of given cuboids, sphere, cone and cylinder. 4d. Determine volume of given cuboids, sphere, cone and cylinder.	4.1 Area of regular closed figures, Area of triangle, square, parallelogram, rhombus, trapezium and circle. 4.2 Volume of cuboids, cone, cylinders and sphere.
Unit –V Statistics	5a. Obtain the range and coefficient of range of the given grouped and ungrouped data. 5b. Calculate mean and standard deviation of discrete and grouped data related to the given simple engineering problem. 5c. Determine the variance and coefficient of variance of given grouped and ungrouped data 5d. Justify the consistency of given simple sets of data.	5.1 Range, coefficient of range of discrete and grouped data. 5.2 Mean deviation and standard deviation from mean of grouped and ungrouped data, weighted means 5.3 Variance and coefficient of variance. 5.4 Comparison of two sets of observation.

Suggested Specification Table for Question Paper Design:

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Algebra	20	02	08	10	20
II	Trigonometry	18	02	08	10	20
III	Coordinate Geometry	08	02	02	04	08
IV	Mensuration	08	02	02	04	08
V	Statistics	10	02	05	07	14
Total		**64**	**10**	**25**	**35**	**70**

Legends :

R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note:

This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

Recommended by MSBTE Text Books and Reference Books

1.	Higher Engineering Mathematics –	Grewal, B.S.	Khanna Publiations, New Deli 2015 ISBN:8174091955
2.	Advanced Engineering Mathematics-	Krezig Ervin ,	Wiley Publications, New Delhi 2014, ISBN : 978-0-470-45836-5
3.	Engineering Mathematics (third edition) –	Croft, Anthony ,	Person Education, New Delhi 2014, ISBN, 9788131726051
4.	Getting Started with MATLAB – 7 –	Pratap Rudra	Oxford University Press, New Delhi, 2014, ISBN : 0199731241
5.	Advanced Engineering Mathematics -	Das, H.K. –	S.Chand & Co. New Delhi 2008, ISBN -9788121903455

Software/Learning Websites

1. www.scilab.org. – SCI Lab
2. www.mathworks.com/products/matlab/ - MATLAB
3. www.dplot.com/ - DPlot
4. www.allmathcad.com/ - MathCAD
5. www.wolfram.com/mathematica/ - Mathematica
6. https : //www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig.
7. www.easycalculation.com
8. www.math-magic.com

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CONTENTS

UNIT : I

UNIT : II

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Unit – I
Algebra

Unit I

Chapter 1

Logarithm

Syllabus :

- Logarithm : Concept and laws of logarithm

1.1 INTRODUCTION :

Logarithm is the reverse process of taking exponent, so we must have a good grasp on exponents before we can hope to understand logarithms properly.Now a day's science as whole is advancing leaps and bounds. Logarithm is an operation which plays a vital role in calculators and computers.It is especially true in case of calculators. Computers whose latest generations have made huge mathematical calculations so simple & astonishingly speedy.

In this article we discuss the fundamentals of logarithm. However, before we can deal with logarithms we need to revise indices. This is because logarithms and indices are closely related, and in order to understand logarithms, a good knowledge of indices is required.

1.2 LAWS OF INDICES :

a) Product of power : $a^m \times a^n = a^{m+n}$

b) Quotient of power : $\frac{a^m}{a^n} = a^{m-n}$

c) Power of a power : $(a^m)^n = a^{mn}$

d) Power of a product : $(a \cdot b)^n = a^n \cdot b^n$

e) Power of a quotient : $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

f) Root of power : $\sqrt[n]{a^m} = a^{m/n}$

g) Negative exponent : $a^{-n} = \frac{1}{a^n}$

h) Zero exponent : $a^0 = 1 \; ; (a \neq 0)$

1.3 DEFINITION OF LOGARITHM :

If $a^x = y$ then $x = \log_a y$; $a, y \in R^+$ & $x \in R$ is called logarithm of y to the base a and is read as " If a raise to x is equal to y then x is equal to log of y to the base a". Here a & y are both positive real numbers and x is any real number.

Note: i) Logarithm of positive numbers is defined.

ii) Logarithm of negative numbers is not defined.

iii) Logarithm of zero is not defined.

1.4 LAWS OF LOGARITHM :

1. $\log_a x + \log_a y = \log_a(x.y)$

   We can extend this result as

   $\log_a x + \log_a y + \log_a z + \cdots\cdots\cdots = \log_a(x.y.z.\cdots\cdots)$

2. $\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$

3. $\log_a(x)^n = n \log_a x$

4. Change of base theorem. $\log_y x = \frac{\log_a x}{\log_a y}$

Deductions :

1. $\log_a 1 = 0$ $\because$ $a^0 = 1$
2. $\log_a a = 1$ $\because$ $a^1 = a$
3. $\log_y x = \frac{1}{\log_x y}$ $\therefore$ $\log_y x \,.\, \log_x y = 1$
4. $\log_a\left(\frac{1}{x}\right) = -\log_a x$ $\therefore$ $\log_a\left(\frac{x}{y}\right) = -\log_a\left(\frac{x}{y}\right)$
5. $a^{\log_a x} = x$ $\cdots\cdots\cdots$ by definition $\therefore e^{\log_e x} = x$
6. If $\log_a x = \log_a y$ then $x = y$

1.5 TYPES OF LOGARITHM :

There are two types of logarithm namely common and Natural or Naperian logarithm.

a) Common logarithm :

The logarithm to the base 10 is called common logarithm i.e. $\log_{10} x$ is called as common logarithm.

b) Natural/ Naperian logarithm :

The logarithm to the base 'e' is called Natural or Naperian logarithm and is noted with special symbol$\ln(x) = \log_e x$. Here e = 2.718281

1.6 RELATION BETWEEN COMMON AND NATURAL LOGARITHM :

We can form the relation between common and natural logarithm as follows

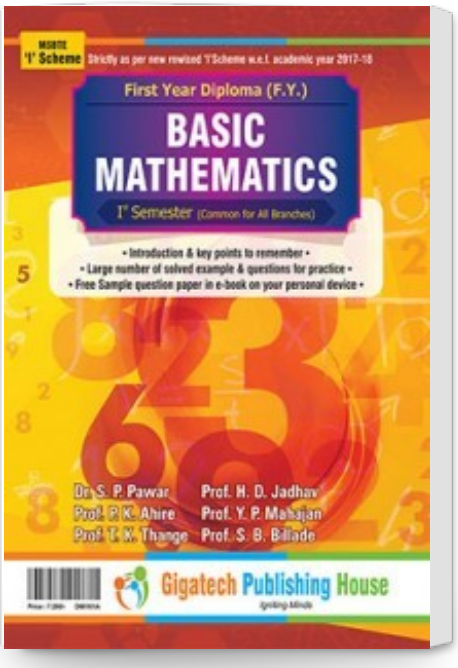
$$\log_e x = \frac{\log_{10} x}{\log_{10} e} \quad \text{by change of base theorem}$$

$$\Rightarrow \quad \log_e x = \frac{\log_{10} x}{\log_{10}(2.718281)} = \frac{\log_{10} x}{0.4343}$$

$$\Rightarrow \quad \mathbf{\log_e x = 2.303 \log_{10} x}$$

This is the required relation between common and natural logarithm

Basic Mathematics Semester I (Common for all branches)



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