

**COURSE TITLE** : **ENGINEERING MATHEMATICS – I**  
**COURSE CODE** : **1002**  
**COURSE CATEGORY** : **F**  
**PERIODS/WEEK** : **6**  
**PERIODS/SEMESTER** : **90**  
**CREDITS** : **6**

**TIME SCHEDULE**

<b>MODULE NO.</b>	<b>CHAPTER NO</b>	<b>CHAPTER TITLE</b>	<b>PERIODS.</b>
<b>I</b>	<b>TRIGONOMETRY-I</b>		
	<b>1</b>	ANGLES	<b>2</b>
	<b>2</b>	TRIGONOMETRIC RATIOS	<b>5</b>
	<b>3</b>	TRIGONOMETRIC RATIOS OF RELATED ANGLES	<b>5</b>
	<b>4</b>	HEIGHTS AND DISTANCES	<b>4</b>
	<b>5</b>	COMPOUND ANGLES	<b>6</b>
<b>II</b>	<b>TRIGONOMETRY-II</b>		
	<b>6</b>	MULTIPLE AND SUB MULTIPLE ANGLES	<b>4</b>
	<b>7</b>	SUM OR DIFFERENCE FORMULAE AND CONVERSE	<b>4</b>
	<b>8</b>	PROPERTIES AND SOLUTIONS OF TRIANGLES	<b>10</b>
<b>III</b>	<b>DIFFERENTIAL CALCULUS</b>		
	<b>9</b>	FUNCTIONS AND LIMITS	<b>4</b>
	<b>10</b>	DIFFERENTIATION-I	<b>10</b>
	<b>11</b>	DIFFERENTIATION-II	<b>10</b>
<b>IV</b>	<b>APPLICATIONS OF DIFFERENTIATION</b>		
	<b>12</b>	EQUATIONS OF TANGENTS AND NORMALS	<b>4</b>
	<b>13</b>	RATES AND MOTION	<b>8</b>
	<b>14</b>	MAXIMA AND MINIMA	<b>4</b>
	<b>15</b>	TUTORIALS, TESTS, ASSIGNMENTS	<b>10</b>
<b>TOTAL PERIODS</b>			<b>90</b>

## **COURSE OUTCOME:**

Students will be able to:-

- Describe the concept of an angle, its units and measurement.
- Define trigonometric ratios  
comprehend trigonometric ratios of standard angles
- Understand related angles of the type  $(n 90 \pm \theta)$  and solve simple problems on related angles
- Estimate heights and distances using trigonometry
- Define compound angles, multiple and sub multiple angles and state compound angles, multiple and sub multiple angles, sum or difference & converse formulae apply these formulae in solving problems
- State sine rule, cosine rule, tangent rule & projection formula and apply these rules to solve a given triangle
- Distinguish variables, constants and functions
- Evaluate the limit of a given function
- Define derivative of a function
- State standard results and rules of differentiation
- Apply the results and rules to solve problems
- Perform different methods of differentiation
- Solve problems on successive differentiation up to second order
- Illustrate derivative as a rate measurer
- Formulate and compute velocity and acceleration of a moving body
- Identify derivative as the slope of the tangent
- Estimate rate of change in related rate problems
- Evaluate maximum and minimum values of a function
- Solve simple problems on maxima and minima

## **SPECIFIC OUTCOME**

### **MODULE-I TRIGONOMETRY-I**

#### **1.1 ANGLE**

- 1.1.1 Definition of an angle.
- 1.1.2 Concept of an angle in trigonometry ,
- 1.1.3 Different systems of measuring an angle.
- 1.1.4 Definition of degree and radian.
- 1.1.5 Express a right angle in different systems,
- 1.1.6 Relation between degree & radian .

## **1.2 TRIGONOMETRIC RATIOS.**

- 1.2.1 Definition of Trigonometric ratios
- 1.2.2 Trigonometric identities.(statements only)
- 1.2.3 Problems based on trigonometric identities,
- 1.2.4 Trigonometric ratios of standard angles like  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $90^\circ$ .

### 1.2.5 Problems.

## **1.3 TRIGONOMETRIC RATIOS OF RELATED ANGLES**

- 1.3.1 Angle of any magnitude and sign
- 1.3.2 Give examples to differentiate positive and negative angles
- 1.3.3 Trigonometric ratios in different quadrants and signs ASTC-Rule
- 1.3.4 Finding all other t-functions, when a t-function in a particular quadrant is given.
- 1.3.5 Complementary angles and relation between trigonometric ratios of complementary angles.
- 1.3.6 Formulae of  $90^\circ \pm \theta$ ,  $180^\circ \pm \theta$ ,  $270^\circ \pm \theta$ ,  $360^\circ \pm \theta$  and  $(-\theta)$
- 1.3.7 Evaluation of  $\sin 120$ ,  $\cos 330$ ,  $\tan 315$
- 1.3.8 Problems on related angles.

## **1.4 HEIGHTS AND DISTANCES**

- 1.4.1 Angle of elevation and angle of depression.
- 1.4.2 Simple problems on height and distance.

## **1.5 COMPOUND ANGLES.**

- 1.5.1 Compound angles
- 1.5.2 Examples for compound angles.
- 1.5.3 Formulae of  $\sin(A+B)$ , and  $\cos(A+B)$ ,
- 1.5.4  $\tan(A+B)$  in terms of  $\tan A$  and  $\tan B$
- 1.5.5 Formula for  $\sin(A-B)$ ,  $\cos(A-B)$  and  $\tan(A-B)$ .
- 1.5.6 Simple problems on compound angles.

## **MODULE-II TRIGONOMETRY-II**

### **2.1 MULTIPLE AND SUBMULTIPLE ANGLES.**

- 2.1.1 Multiple and sub multiple angles with examples.
- 2.1.2 Formulae for  $\sin 2A$ ,  $\cos 2A$  and  $\tan 2A$  (statements only)
- 2.1.3 Formulae for  $\sin 3A$ ,  $\cos 3A$  (statements only)
- 2.1.4 Simple problems on multiple angles (problems involving half angle formulae are excluded)

### **2.2 SUM OR DIFFERENCE FORMULAE AND CONVERSE**

- 2.2.1 Expressions for  $\sin C \pm \sin D$  and  $\cos C \pm \cos D$  in terms of Product of trigonometric ratios.
- 2.2.2 Expressions for  $\sin A \cos B$ ,  $\cos A \sin B$ ,  $\cos A \cos B$  and  $\sin A \sin B$  in terms of the sum and difference of trigonometric ratios.
- 2.2.3 Simple problems.

## 2.3 PROPERTIES AND SOLUTION OF TRIANGLES.

- 2.3.1 The relation between sides of a triangle and Sines, Cosines and Tangents of any angle
- 2.3.2 Sine rule, Cosine rule and Tangent rule-(statements only.) ,
- 2.3.3 Projection formulae in any triangle.(no proof)
- 2.3.4 Simple problems on above rules.
- 2.3.5 Solution of a triangle in the following cases when
  - (i) All the three sides are given
  - (ii) Two sides and included angle are given
  - (iii) Two angles and one side is given
- 2.3.6 Area of a triangle (Formulae and simple problems, no proof) when,
  - (i) All the three sides a, b and c are given
  - (ii) Two sides and one included angle are given

## MODULE-III DIFFERENTIAL CALCULUS

### 3.1 FUNCTIONS AND LIMITS.

- 3.1.1 Variables and Constants.
- 3.1.2 Dependent and independent variables.
- 3.1.3 Definition of a function
- 3.1.4 Explicit and implicit functions
- 3.1.5 Concept of limit of a function (intuitive idea only).
- 3.1.6 Need for this concept in finding instantaneous rate of change like velocity and slope.
- 3.1.7 Explanation of  $\lim_{x \rightarrow 0} \frac{1}{x} = \infty$  and  $\lim_{x \rightarrow \infty} \frac{1}{x} = 0$ ,
- 3.1.8 Simple problems on evaluation of limits of functions
  - (i) When x tends to 'a'
  - (ii) By factorization,
  - (iii) When x tends to ' $\infty$ '
- 3.1.9 Algebraic and trigonometrical limits:-
  - 1)  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$  for any rational number.
  - 2)  $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$  where  $\theta$  is in radians
- 3.1.10 Simple problems on evaluation of limits based on direct application of the above standard limits.

### 3.2 DIFFERENTIATION-I

- 3.2.1 Increment and incremental ratio.
- 3.2.2 Differential coefficient or derivative of a function.
- 3.2.3 Derivatives of functions of  $x^n$ ,  $\sin x$ , and  $\cos x$  with respect to 'x' from method of first principles
- 3.2.4 List of standard derivatives.

- 3.2.5 Derivatives of  $e^x$  and  $\log x$  (no proof).
- 3.2.6 Derivatives of inverse trigonometric functions (no derivation)
- 3.2.7 Rules of differentiation: Sum, product and quotient of functions.
- 3.2.8 Simple problems based on these rules.

### **3.3 DIFFERENTIATION-II**

- 3.3.1 Derivatives of function of a function (Chain rule).
- 3.3.2 Problems based on chain rule.
- 3.3.3 Differentiation of Implicit functions and Parametric functions.
- 3.3.4 Simple problems on differentiation of implicit functions and parametric functions.
- 3.3.5 Successive differentiation up to second order.
- 3.3.6 Problems on successive differentiation.

## **MODULE-IV APPLICATIONS OF DIFFERENTIAL CALCULUS**

### **4.1 EQUATIONS OF TANGENTS AND NORMALS**

- 4.1.1 Geometrical meaning of derivative
- 4.1.2 Slope of a curve at a point.
- 4.1.3 Equations of tangent and normal to the curve  $y = f(x)$  at a given point.

### **4.2 RATES AND MOTION**

- 4.2.1 Derivative as a rate measurer
- 4.2.2 Simple problems of rates occurring in engineering..
- 4.2.3 Velocity and acceleration
- 4.2.4 Simple problems to find velocity and acceleration of a moving body 13.5 when displacement 's' is given in terms of 't' and related problems
- 4.2.5 Problems to determine the rate of change of a variable, when the rate of change of some related variable is given.

### **4.3 MAXIMA AND MINIMA**

- 4.3.1 Increasing and decreasing functions.
- 4.3.2 Conditions for maxima and minima.(No proof)
- 4.3.3 Maxima and minima of a function.
- 4.3.4 Simple direct problems on maxima and minima.

## **CONTENTS DETAILS**

### **MODULE - I**

#### **1.1 ANGLES**

Definition of an angle, Concept of an angle in trigonometry Different systems of measuring an angle, Definition of degree and radian, Express a right angle in different systems,  
Relation between degree & radian.

## 1.2 TRIGONOMETRIC RATIOS.

Definition of Trigonometric ratios, Trigonometric identities. (Statements only), Problems based on trigonometric identities, Trigonometric ratios of standard angles like  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $90^\circ$ . Problems.

## 1.3 TRIGONOMETRIC RATIOS OF RELATED ANGLES

Angle of any magnitude and sign, positive and negative angles  
Trigonometric ratios in different quadrants and signs  
ASTC-Rule, Complementary angles and relation between trigonometric ratios of complementary angles.  
Signs of trigonometric functions of related angles, Given a trigonometric functions of an angle and its quadrant find others Formulae of  $90^\circ \pm \theta$ ,  $180^\circ \pm \theta$ ,  $270^\circ \pm \theta$ ,  $360^\circ \pm \theta$  and  $(-\theta)$ , Problems on related angles, Evaluation of  $\sin 120^\circ$ ,  $\cos 330^\circ$ ,  $\tan 315^\circ$

## 1.4 HEIGHTS AND DISTANCES

Angle of elevation and angle of depression. Simple problems

## 1.5 COMPOUND ANGLES.

Compound angles, Examples, Addition and subtraction formulae, Expression of  $\tan(A+B)$  in terms of  $\tan A$  and  $\tan B$ , Simple problems on compound angles.

## MODULE - II

### 2.1 MULTIPLE AND SUBMULTIPLE ANGLES.

Multiple and sub multiple angles with examples, Formulae for  $\sin 2A$ ,  $\cos 2A$ ,  $\tan 2A$ ,  $\sin 3A$ ,  $\cos 3A$  (without proof), problems on multiple angles (problems involving half angle formulae are excluded)

### 2.2 SUM OR DIFFERENCE FORMULAE AND CONVERSE

Sum, Difference, product formulae, converse of product formulae (without proof) and simple problems based on it.

### 2.3 PROPERTIES AND SOLUTION OF TRIANGLES.

Sine rule, Cosine rule and Tangent rule-(statements only.), Projection formulae in any triangle.(no proof), Simple problems on above rules. Solution of a triangle when all the three sides are given, two sides and included angle are given two angles and one side is given Area of a triangle (Formulae and simple problems, no proof) when all the three sides  $a$ ,  $b$  and  $c$  are given & when two sides and one included angle are given

## **MODULE - III**

### **3.1 FUNCTIONS AND LIMITS.**

Variables and Constants. Dependent and independent variables Definition of a function Explicit and implicit functions, Concept of limit of a function, Explanation of  $\lim_{x \rightarrow 0} \frac{1}{x} = \infty$  and  $\lim_{x \rightarrow \infty} \frac{1}{x} = 0$ , Simple problems on evaluation of limits of functions(i) when  $x$  tends to 'a'(ii) by factorization, (iii) when  $x$  tends to ' $\infty$ ' Algebraic and trigonometrical limit( without proof) and simple problems based on it

### **3.2 DIFFERENTIATION-I**

Increment and incremental ratio, derivative of a function, Derivatives of functions of  $x^n$ ,  $\sin x$  and  $\cos x$  with respect to ' $x$ ' from method of first principles, List of standard derivatives. Derivatives of  $e^x$ ,  $\log x$  & Derivatives of inverse trigonometric functions (no derivation), Rules of differentiation: Sum, product and quotient of functions. Simple problems based on these rules.

### **3.3 DIFFERENTIATION-II**

Derivatives of function of a function (Chain rule).Problems based on chain rule. Differentiation of Implicit functions and Parametric functions. Simple problems on differentiation of implicit functions and parametric functions, Successive differentiation up to second order. Problems on successive differentiation.

## **MODULE - IV**

### **4.1 EQUATIONS OF TANGENTS AND NORMALS**

Geometrical meaning of derivative Slope of a curve at a point. Equations of tangent and normal to the curve  $y = f(x)$  at a given point.

### **4.2 RATES AND MOTION**

Derivative as a rate measurer, Simple problems of rates occurring in engineering, Velocity and acceleration, Simple problems to find velocity and acceleration of a moving body when displacement ' $s$ ' is given in terms of ' $t$ ' and related problems. Problems to determine the rate of change of a variable, when the rate of change of some related variable is given.

### **4.3 MAXIMA AND MINIMA**

Increasing and decreasing functions. Conditions for maxima and minima.(No proof) Maxima and minima of a function. Simple direct problems on maxima and minima

**NB: Emphasis is given in application oriented problems and hence proofs and derivations are not expected.**

#### **Text Book:**

Engineering Mathematics-I for polytechnic colleges by different authors.

**Reference Books:**

Anton - Calculus, 7 edn. - WILEY

Dr.M.K.Venkatraman - Engineering Mathematics - National Publishing Co,  
Chennai

Dr.P.Kandasamy & Others - Engineering Mathematics - S.Chand & Co Ltd, New Delhi