

# **LESSON PLAN**

## **ENGINEERING MATHEMATICS-II**

**PREPARED BY**  
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**GOVERNMENT POLYTECHNIC BARGARH**

**DEPARTMENT OF MATHEMATICS & SCIENCE**



# GOVERNMENT POLYTECHNIC BARGARH

## **VISION**

To be a reputed polytechnic institute imparting quality technical education to produce diploma engineers with dynamic personalities and innovative competencies in the state of Odisha.

## **MISSION**

- To offer the best and advanced lab facilities adhering to the curriculum to make future engineers.
- To engage highly qualified and competent faculties to make the student acquire the skillful knowledge required.
- To develop an excellent teaching learning environment leading to create the best institute.



## SYLLABUS

### **Th.3. ENGINEERING MATHEMATICS – II** **( 2<sup>nd</sup> Sem Common)**

Theory: 5 Periods per Week  
Total Periods: 75 Periods  
Examination: 3 Hours

I.A : 20 Marks  
End Sem Exam : 80 Marks  
TOTAL MARKS : 100 Marks

#### **Objective:**

Principles and application in Engineering are firmly ground on abstract mathematical structures. Students passing from secondary level need familiarization with such structure with a view to develop their knowledge, skill and perceptions about the applied science. Calculus is the most important mathematical tool in forming engineering application into mathematical models. Wide application of calculus makes it imperative to develop methods of solving differential equations. The knowledge of limit, derivative and derivative needs to be exhaustively practiced. To help a systematic growth of skill in solving equation by calculus method will be the endeavor of this course content. Understanding the concept of co-ordinate system in 3D in case of lines, planes and sphere and it's use to solve Engineering problems. After completion of the course the student will be equipped with basic knowledge to form equations and solve them competently.

#### **Topic wise distribution of periods**

<b>Sl. No.</b>	<b>Topics</b>	<b>Periods</b>	<b>Marks</b>
1	Vector Algebra	15	12
2	Limits and Continuity	12	12
3	Derivatives	21	20
4	Integration	15	24
5	Differential Equation	12	12
<b>TOTAL</b>		<b>75</b>	<b>80</b>



## COURSE CONTENTS:

3) DERIVATIVES  
a) Derivative  
b) Algebra  
c) Derivative

### 1) VECTOR ALGEBRA

- a) Introduction
- b) Types of vectors (null vector, parallel vector, collinear vectors)  
(in component form)
- c) Representation of vector
- d) Magnitude and direction of vectors
- e) Addition and subtraction of vectors
- f) Position vector
- g) Scalar product of two vectors
- h) Geometrical meaning of dot product
- i) Angle between two vectors
- j) Scalar and vector projection of two vectors
- k) Vector product and geometrical meaning  
(Area of triangle and parallelogram)

### 2) LIMITS AND CONTINUITY

- a) Definition of function, based on set theory
- b) Types of functions
  - i) Constant function
  - ii) Identity function
  - iii) Absolute value function
  - iv) The Greatest integer function
  - v) Trigonometric function
  - vi) Exponential function
  - vii) Logarithmic function
- c) Introduction of limit
- d) Existence of limit
- e) Methods of evaluation of limit

$$\text{i) } \lim_{x \rightarrow 0} \frac{x^n - a^n}{x - a} = na^{n-1}$$

$$\text{ii) } \lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \log_e a$$

$$\text{iii) } \lim_{x \rightarrow 0} \frac{e^x - 1}{x} = 1$$

$$\text{iv) } \lim_{x \rightarrow 0} (1 + x)^{1/x} = e$$

$$\text{v) } \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x = e$$

$$\text{vi) } \lim_{x \rightarrow 0} \frac{\log(1+x)}{x} = 1$$

$$\text{vii) } \lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

$$\text{viii) } \lim_{x \rightarrow 0} \frac{\tan x}{x} = 1$$

- e) Definition of continuity of a function at a point and problems based on it



### 3) DERIVATIVES

- a) Derivative of a function at a point
- b) Algebra of derivative
- c) Derivative of standard functions  
 $x^n, a^x, \log_a x, e^x, \sin x, \cos x, \tan x, \cot x, \sec x, \csc x, \sin^{-1} x, \cos^{-1} x, \tan^{-1} x, \cot^{-1} x, \sec^{-1} x, \csc^{-1} x$
- d) Derivative of composite function (Chain Rule)
- e) Methods of differentiation of
  - i) Parametric function
  - ii) Implicit function
  - iii) Logarithmic function
  - iv) a function with respect to another function
- f) Applications of Derivative
  - i) Successive Differentiation (up to second order)
  - ii) Partial Differentiation (function of two variables up to second order)
- g) Problems based on above

### 4) INTEGRATION

- a) Definition of integration as inverse of differentiation
- b) Integrals of standard functions
- c) Methods of integration
  - i) Integration by substitution
  - ii) Integration by parts
- d) Integration of the following forms
  - i)  $\int \frac{dx}{x^2+a^2}$  ii)  $\int \frac{dx}{x^2-a^2}$  iii)  $\int \frac{dx}{a^2-x^2}$  iv)  $\int \frac{dx}{\sqrt{x^2+a^2}}$  v)  $\int \frac{dx}{\sqrt{x^2-a^2}}$  vi)  $\int \frac{dx}{\sqrt{a^2-x^2}}$
  - vii)  $\int \frac{dx}{x\sqrt{x^2-a^2}}$  viii)  $\int \sqrt{a^2-x^2} dx$  ix)  $\int \sqrt{a^2+x^2} dx$  x)  $\int \sqrt{x^2-a^2} dx$
- e) Definite integral, properties of definite integrals
  - i)  $\int_0^a f(x) dx = \int_0^a f(a-x) dx$
  - ii)  $\int_a^b f(x) dx = - \int_b^a f(x) dx$
  - iii)  $\int_a^c f(x) dx = \int_a^b f(x) dx + \int_b^c f(x) dx, a < b < c$
  - iv)  $\int_{-a}^a f(x) dx = 0, \text{ if } f(x) = \text{odd}$   
 $= 2 \int_0^a f(x) dx, \text{ if } f(x) = \text{even}$
- f) Application of integration
  - i) Area enclosed by a curve and X-axis
  - ii) Area of a circle with centre at origin

### 5) DIFFERENTIAL EQUATION

- a) Order and degree of a differential equation
- b) Solution of differential equation
  - i) 1st order and 1st degree equation by the method of separation of variables
  - ii) Linear equation  $\frac{dy}{dx} + Py = Q$ , where P, Q are functions of x

**Syllabus to be covered up to IA**  
**Ch. 2 and Ch. 3**

#### Books Recommended:

1. Elements of Mathematics \_ Vol. \_ 1 & 2 (Odisha State Bureau of Text Book preparation & Production)

#### Reference Books:

Mathematics Part- I & Part- II- Textbook for Class XII, NCERT Publication



## **COURSE OUT COME:-**

AFTER COMPLETION OF THE COURSE, THE STUDENTS WILL BE ABLE TO

**CO1:-** Understand the basics of vectors, operations on vectors and their geometrical interpretation.

**CO2:-** Recognize and describe the way in which limit of the function exists, Calculate limit in determinant form and verify the continuity of a function at a point.

**CO3:-** Elucidate the definition of derivatives and apply its concepts analytically, graphically and numerically. As well as calculate higher order derivatives & Partial derivatives.

**CO4:-** Evaluate area enclosed by a curve & Co-ordinate axis and evaluate definite and indefinite integrals by different method of integrations.

**CO5:-** Analyze the concept of differential equations, its order and degree .Equipped with basic knowledge to form equations and solve them competently.







	16-05-2023	Discussion of Probable questions and answers.
9 th	17-05-2023	Definitions of integrations and some basic formulae
	18-05-2023	Integration of standard functions
	20-05-2023	Integration by substitution methods
	22-05-2023	Problems
	23-05-2023	Problems
	23-05-2023	Discussion of Probable questions and answers.
10 th	24-05-2023	Integration by parts
	25-05-2023	Problems
	27-05-2023	Problems
	29-05-2023	Problems
	30-05-2023	Problems
	30-05-2023	Discussion of Probable questions and answers.
11 th	31-05-2023	Definite integration & their properties
	01-06-2023	Problems
	03-06-2023	Problems
	05-06-2023	Application of integrations
	06-06-2023	problems
	06-06-2023	Discussion of Probable questions and answers.
12th	07-06-2023	Definition, order and degree of differential equations
	08-06-2023	Solution of differential equation by variable separable method
	10-06-2023	Solution of Linear differential equation with constant coefficient
	12-06-2023	Problems
	13-06-2023	Problems
	13-06-2023	Discussion of Probable questions and answers.
13 th	17-06-2023	Discussion of Probable questions and answers.
	19-06-2023	Discussion of Probable questions and answers.
	21-06-2023	Discussion of Probable questions and answers.
	22-06-2023	Discussion of Probable questions and answers.
	23-06-2023	Discussion of Probable questions and answers.
	24-06-2023	Discussion of Probable questions and answers.
14 th	26-06-2023	Discussion of Probable questions and answers.
	27-06-2023	Discussion of Probable questions and answers.
	27-06-2023	Discussion of Probable questions and answers.

*J. J. J.*  
Signature of the faculty

*[Signature]*  
Signature of the HOD