TH – 1 ENGINEERING MATHEMATICS – II

Periods / Week – 6 Periods **Th – 80**
Total periods – 90 Periods **IA – 20**
Examination – 3 Hours

TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No	Topics	Units	Periods
1.	Differential Calculus Partial differentiation	I II	25 08
2.	Integral Calculus	III	25
3.	Differential Equation	IV	07
4.	Three dimensional Geometry	V	15
5.	Stastistics	VI	05
6.	Probability	VII	05
	Total		**90**

OBJECTIVES :

Principle and applications 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 anti derivative needs to be exhaustively practiced. To help a systematic growth of skill in solving equation by calculus method will be the endeavour of this course content. Understand 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.

Unit – I : DIFFERENTIAL CALCULUS (30 Periods)

1.0 LIMITS AND CONTINUITY

1.1. Define variables, constants, function of real variables, domain and range

1.2 Explain Graphical representation of functions

1. Absolute value function ($|x|$)
2. Greatest integer function $[x]$,
3. Trigonometric function.
4. Inverse circular function
5. Exponential function (e^x)
6. Logarithmic function ($\log x$)
7. Signum function

1.3 Define limit of a function, Right Hand Limit, Left Hand Limit & Existence of Limits. Methods of evaluating limit, when $x \to \infty$ (Infinite limits)

1.4 State fundamental theorem on limits. Find the standard limits.

1. Algebraic limits

(a) $\lim_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$

(b) $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$

(c) $\lim_{x \to 0} \frac{e^x - 1}{x} = 1$

(d) $\lim_{x \to 0} (1 + x)^{1/x} = e$

(e) $\lim_{x \to 0} \frac{\log(1 + x)}{x} = 1$

2. Trigonometric limits : $\lim_{x \to 0} \frac{\sin x}{x} = 1$, $\lim_{x \to 0} \frac{\tan x}{x} = 1$

1.5 Define continuity of functions at a point in the domain of the function say at $(x = a)$

1.6 Problems on above (1.1 – 1.5)

2.0 DERIVATIVES

2.1 Define derivatives of functions at a given point $(x = c)$

2.2 Differentials dx, dy etc. Establish geometrical and physical meaning of $\frac{dy}{dx}$

Differential coefficient / quotient, $\frac{dy}{dx}$, differential operator $(D = d/dx)$

Derivative as rate measure and extension of concept of limits. Fundamental theorem on derivative viz (addition rule, subtraction rule, product rule and quotient rule).

2.3 Standard derivative of functions such as x^n, a^x, $\log_a x$, e^x, $\log_e x$, $\sin x$, $\cos x$, $\tan x$, $\sin^{-1} x$, $\cos^{-1} x$, $\tan^{-1} x$, from first principle methods.

2.4 Perform derivative of composite function

2.5 Perform logarithmic differentiation, Differentiation of parametric function, Differentiation of implicity function, Differentiation of a fuction with respect to another function.

2.6 Define successive differentiation (up to 2nd order).

2.7 Define maxima and minima, turning points, find the condition and interpret the critical points and points of inflexions.

2.8 Define local extremum, Absolute maxima / minima.

2.9 Problems on above (2.1 – 2.8)

Unit – II : PARTIAL DIFFERENTIATION (8 Periods)

3.1 Explain functions of several variables.

3.2 State partial derivatives upto three independent variables

3.3 State homogeneous function of two variables and Euler's theorem on Homogenous function for two variables.

3.4 Problems on above (3.1 – 3.3)

Unit – III : INTEGRAL CALCULUS (INTEGRATION) (20 Periods)

4.1 Define integration as inverse process of differentiation.

4.2 Define indefinite and definite integral.

4.3 State integrals of standard functions.

4.4 Establish formula for the following :

$$\int \frac{dx}{x^2+a^2}, \int \frac{dx}{x^2-a^2}, \int \frac{dx}{\sqrt{x^2+a^2}}, \int \frac{dx}{x\sqrt{x^2-a^2}}, \int \frac{dx}{\sqrt{x^2-a^2}},$$

$$\int \frac{dx}{a^2-x^2}, \int \frac{dx}{\sqrt{a^2-x^2}}, \int \sqrt{a^2+x^2}\,dx, \int \sqrt{a^2-x^2}\,dx, \int \sqrt{x^2-a^2}\,dx$$

4.5 Explain methods of integration

(i) Integration by substitution

(ii) Integration by decomposition of integrand

(iii) Integration by parts

(iv) Integration by Partial Fraction

4.6 Integration of some more trigonometric function.

$$\int \frac{dx}{a\cos x + b\sin x}, \int \frac{dx}{a+b\cos x}, \int \frac{dx}{a+b\sin x}$$

4.7 Definite integrals, properties of definite integrals.

4.8 Find area bounded by the function $y = f(x)$ ordinate $x = a$ to $x = b$ and x axis and the area bounded by the function $x = f(y)$, absicissa, $y = c$ to $y = d$ and y - axis

Area bounded by two curves.

4.9 Problems on above (4.1 – 4.8)

Unit – IV : DIFFERENTIAL EQUATION (7 Periods)

5.1 Define differential equation. Order and Degree of differential equation.

5.2 Formation of first order first degree differential equation.

5.3 Solution of first order and first degree differential equation by the following methods

1. Separation of variables.
2. Homogeneous.
3. Linear
4. Exact.

5.4 Problems on above (5.1 – 5.3)

Unit – V : ANALYTICAL GEOMETRY IN THREE DIMENSIONS (15 Periods)

6.1 Describe co-ordinates of a point in rectangular co-ordinate system.

6.2 Derive distance formula, Division formula.

6.3 Explain, DCS & DRS of a line, the formula for angle between two lines with given DRS. Conditions of perpendicularity and parallelism.

6.4 State Equation of a plane.

6.5 Find equation of a plane under different conditions.

1. General form. $ax + by + cz + d = 0$, where a, b, c are DRS normal to a plane.
2. Intercept form $(x/a + y/b + z/c = 1)$
3. Normal form
4. Passing through point of intersection of two planes.

6.6 Find angle between two planes.

6.7 Find perpendicular distance from a point to a plane.

6.8 Problems on above (6.1 – 6.7)

7.0 SPHERE

7.1 Define sphere, equation of a sphere

7.2 Find the equation of a sphere whose centre and radius is given

7.3 Derive general equation of a sphere, equation of a sphere on a given diameter and equation of a sphere passing through four non-coplanar points.

7.4 Problems on above (7.1 – 7.3)

8.0 STASTISTICS (UNIT – VI)

8.1 Measures of central tendency (Mean, Median & Mode)

8.2 Formulaes for determination of Mean, Median & Mode.

8.3 Measure of dispersion, formulaes for mean deviation, Standard deviation and variance.

8.4 Problems on above (8.1 – 8.3)

9.0 PROBABILITY (UNIT – VII)

9.1 Experiment, outcome, sample space, event and probability of an event.

9.2 Equally likely, mutually, exclusive independent event.

9.3 Theorems on probability,

(a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, (b) $P(A) + P(A^c) = 1$

9.4 Problems on above (9.1 – 9.3)

BOOKS RECOMMENDED :

(1) Elements of Mathematics – Vol – I & II
By Orissa State Bureau of Text Book Preparation & Production

Reference Books :

(1) Fundamentals of Mathematical Statics – by S. C. Gupta and Kapur (S. Chand Publication)

(2) Engg. Mathematics – by H.K. Dass (S. Chand Publication)

(3) Higher Secondary Mathematics – Vol - II, Samal, Mohapatra, Jena, Adhikari,