SUBJECT TITLE : TECHNICAL MATHEMATICS 1I
(Common for All Engineering / Technology programmes)
SUBJECT CODE :
PERIODS/WEEK : 6
PERIODS/SEMESTER : 108
CREDITS : 6

TIME SCHEDULE

Module	Topic	Periods
I	1.1 Functions, Limits & Continuity 1.2 Differentiation	7 20
II	2.1 Applications of Differentiation	27
III	3.1 Indefinite Integral 3.2 Definite Integral	18 9
IV	4. 1 Applications of Integration 4.2 Differential Equations	20 7
Total		**108**

OBJECTIVES

MODULE 1

1.1.0 Functions, Limits and continuity

1.1.1 Give example for functions

1.1.2 Explain the meaning of limit of the following type

1) $\lim f(x) x \to a$

2) $\text{limit } 1/x = 0 \qquad x \to \alpha$

1.1.3 Find the limit of the following type

1) $\text{limit } \frac{2x + 1}{3x - 2}$ as $x \to 1$

2) $\text{limit } \frac{2x^2 + 3x}{5x^2 + 4x + 1}$ as $x \to \alpha$

3) $\text{limit } \frac{x^2 - 3x}{3x^2 - 9}$ as $x \to 3$

1.1.4 State the following results

1) $\text{limit } \frac{x^n - a^n}{x - a} = n a^{n-1}$ as $x \to a$ when n is rational

2) $\text{limit } \frac{\sin \phi}{\phi} = 1$, as $\phi \to 0$

1.1.5 Solve problems of the type

1) Limit $\frac{\sqrt{x} - \sqrt{a}}{}$

x->a x - a

2) limit $\frac{\text{Sin } m\phi}{\phi}$

ϕ->0ϕ

1.1.6 Describe the general definition of continuous functions and simple problems

1.2.0 Differentiation

1.2.1 Define the derivative of a function y = f(x) as limit $\frac{\Delta y}{\Delta x}$

Δx->0 Δx

1.2.2 Find the derivatives of x^n, Sinx, and Cosx from first principles

1.2.3 State the rules of differentiation

1) Sum or difference
2) Product
3) Quotient

12.4 Find derivatives of e^x and log x. State all the fundamental formulae

1.2.5 Apply the rules and differentiate simple functions of the type

1) x^2 sec x
3) $\frac{\tan x}{x^2 + 1}$
3) $\frac{x \text{ Cosec } x}{3x - 2}$

1.2.6 Find the derivatives if the functions of the form
$[f(x)]^n$, Sin f(x), Cos f(x), with respect to x.

1.2.7 Find the derivatives of

^{nx}, log sinx, $(x^2+1)^{10}$ Sec5x, $\frac{\text{Sin } 2x}{1+\cos 2x}$, $\text{Cot}^5 (x^3)$, log (sec x + tan x)

1.2.8 Find the derivative of the implicit functions of the form
f(x,y)=0

1.2.9 Differentiate parametric functions of the type
x = f(t), y = g(t)

1.2.10 Find the second derivative of the functions
$y = x^2 \sin x$, $y = x / x-2$

1.2.11 Solve the problem of the type
If $y = x^2 \cos x$, show that

$$x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + (x^2+6)\, y = 0$$

MODULE - 11

2.1.0 Applications of Differentiation

2.1.1 State geometrical meaning of derivatives

2.1.2 Find the slope of the curve
$y= x^2-3x + 2$ at (3,2)
y = tan x at x = $\pi/3$

2.1.3 Find the equation of the tangent and normal to the semi circle $y = \sqrt{25-x^2}$ at (4,3) on it

2.1.4 Solve problems of the type: The radius of a circular plate is increasing

in length at 0.1 cm per second. What is the rate at which the area is increasing when the radius is 12 cm.

2.1.5 Solve problems of the type: A spherical balloon is inflated with air such that its volume increases at the rate 5.c.c per second. Find the rate at which its curved surface is increasing when its radius is 7 cm.

2.1.6 Solve problems of the type: The displacement 'S' in time 't' is given by S = 2/3t+ Cost at $t = \pi/4$; find the velocity and acceleration

2.1.7 State the conditions for a function
y = f(x) to be (1) increasing (2) decreasing

2.1.8 Apply the concept of derivative to find maxima and minima

2.1.9 Solve the problem of the type:

1) Find the maximum and minimum values of $y = x^3 - 18x^2 + 96x$
2) Prove that a rectangle of fixed perimeter has its maximum area when it becomes a square.

MODULE - III

3.1.0 Indefinite integral

3.1.1 Apply various methods of integration

3.1.2 Explain that $\int f(x)dx = F(x) + c$ means $\frac{d}{dx}[F(x)+c] = f(x)$, c being an arbitrary constant

3.1.3 State the standard formulas of integral x^n, sinx, cos x, e^x, etc

3.1.4 Find the integrals using the rules

1) $\int (u \pm v)\, dx = \int u\,dx \pm \int v\,dx$
2) $\int kudx = k \int udx$

3.1.5 Evaluate the integrals of the form

1) $\int f(ax+b)\, dx$
2) $\int \sin^2 x\, dx$

3.1.6 Evaluate the integrals of the form

1) $\int x \sin(x^2)\, dx$
2) $\int \frac{2x}{4}\, dx$
3) $\int \frac{1}{1+x^5}$
4) $\int \cos^3 x \sin x\, dx$
5) $\int e^{x^2} x\, dx$

3.1.7 Solve the problems of the type

1) $\int x \cos x\, dx$
2) $\int x^2 e^{-x}\, dx$
3) $\int x \log x\, dx$
4) $\int \log x\, dx$

3.2 Definite Integrals

3.2.1 Define the definite integral

$$\int_a^b f(x)\,dx = F(b) - F(a) \text{ where } F^1(x) = f(x)$$

3.2.2 Evaluate the definite integral

1) $\int_0^1 x\,(1-x)^2\,dx$

2) $\int_0^{\pi} \sin^2 x\,dx$

3) $\int_0^1 x\sqrt{1+x^2}\,dx$

4) $\int_0^{\pi} \frac{1-\sin x}{x+\cos x}\,dx$

5) $\int_0^{\pi/2} x\cos x\,dx$

MODULE - IV

4.1.0 Application of Integration

4.1.1 Find the area bounded by a curve, two ordinates (abscissa) and x – axis (y axis)

4.1.2 Find Volume of a solid of revolution about x or y axis

4.2.0 Differential equations

4.2.1 Solve the differential equation of the variable separable type

4.2.2 Solve the differential equation of the form dy/dx + Py = Q where P and Q are functions of x.

CONTENT DETAILS

MODULE – I

Function, Limits & Continuity

Definition, some problems for finding limits, Properties (Statements only)

Limit $\frac{x^n-a^n}{x-a} = n\,a^{n-1}$ as $x \to a$ and limit $\frac{\sin\phi}{\phi} = 1$ as $\phi \to 0$

General definition of continuous functions and simple problems.

Differentiation

Definition of derivative of x^n, Sin x, Cos x etc by using first principle, find derivatives of ex and log x, Fundamental formulas, product and Quotient rules (statement only). Derivatives of other trigonometric functions, Simple problems.

Function of a function rule, Derivatives of implicit and parametric equations, problems, second order derivatives, Simple problems.

MODULE II

Applications of Differentiation

Geometrical meaning of derivatives, Slope, Tangent, Normal and Equation of tangent and normal to the curve, Rate of change.

Problems connecting Area and Volume, Velocity and Accelerations.

Maxima and Minima
Increasing and Decreasing functions, Turning points, Finding Maximum and Minimum values of a function by using derivatives, Conditions for Maximum and Minimum, Simple problems.

MODULE – III

Indefinite Integral
Definition of integration, Fundamental formulas, Problems, Integration by substitution, function of the form $\int f(g(x)\, g^1(x)\, dx$, $\int f(ax + b)^n\, dx$

Integration by parts
Integral of the product of two functions, formula (without proof) and simple problems.
Definite Integral

Definitions, simple problems, $\int_0^{\pi/2} \text{Sin}^2x\, dx$, $\int_0^{\pi/2} \frac{\text{Sin}x}{\sqrt{1-\cos x}}\, dx$

MODULE – IV

Application of integration
Finding areas between the curve y = f(x) and the axes, Volume of the solid, Problems
Differential equations:
Solutions of equations of the form Variable separable, Linear equations.

REFERENCE BOOKS:-

1. Washington A.J. : Basic Technical Mathematics, Addison Wesley
2. Engineering Mathematics : S.S. Sastry
3. Green John. R: Calculus with Analytic Geometry, McGraw Hill Book Co.,
4. Karuppannan. T.C. : Mathematics for Technical Students, Macmillan and Co.,
5. T.T.T.I. Madras : Mathematics for Technicians Vol. I and II, Sehgal Educational Consultants (P) Ltd, Faridabad
6. Shanti Narayanan : Algebra