UNIT 9: Definite Integration

Specific Objectives:

1. To define definite integral intuitively as a limit of sum.
2. To learn the properties of definite integral and its relation with indefinite Integral
3. To evaluate definite integrals.
4. To find plane areas.
5. To evaluate definite integral using the trapezoidal rule.

Detailed Content		Time Ratio	Notes on Teaching
9.1	**Definite integral**	2	With the aids of the concept of limit and the concept of summation of rectangular stripes, students should be able to find out the close relationship between definite integral and the area under a curve. The relation $\int_a^b f(x)\,\mathrm{d}x = F(b) - F(a)$ should be introduced in an intuitive approach.
9.2	**Properties of definite integral**	3	Properties of definite integrals should be introduced: (a) $\int_a^b kf(x)\,\mathrm{d}x = k\int_a^b f(x)\,\mathrm{d}x$ (b) $\int_a^b [f(x) \pm g(x)]\,\mathrm{d}x = \int_a^b f(x)\,\mathrm{d}x \pm \int_a^b g(x)\,\mathrm{d}x$ (c) $\int_a^b f(x)\,\mathrm{d}x = -\int_b^a f(x)\,\mathrm{d}x$ (d) $\int_a^b f(x)\,\mathrm{d}x = \int_a^c f(x)\,\mathrm{d}x + \int_c^b f(x)\,\mathrm{d}x$ (e) $\int_a^b f(x)\,\mathrm{d}x = k\int_a^b f(u)\,\mathrm{d}u$
9.3	**Plane area**	5	The close relation between definite integral and the area under a curve should be observed. However, negative area should be a distinction between the two. Area bounded by two curves should be a simple application of previous knowledge. Sketches of curves under consideration could be provided to help students' thinking.

Detailed Content		Time Ratio	Notes on Teaching
9.4	**Approximation of definite integrals using the trapezoidal rule**	4	Some indefinite Integrals are not readily integrable. However, application of the trapezoidal rule on a definite integral can always give an approximation. It should be pointed out that if a curve is convex upward, the trapezoidal rule under-estimates the required area The revere is the case if the curve is concave upward. However, error estimation is not required.
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