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Sec: A

SUBJECT : Numerical Analysis

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DATE : 06-09-2020

ASSIGNMENT: 01

## Q1) Review of Integration Concept

(Ans) It contains some major concepts of integration, including

- 1) Substitution method-
- 2) Integration by Parts
- 3) Integration Rational Function-

### 1) Substitution method:

$$\int f(g(x)) g'(x) dx = \int f(u) du$$

If the function  $f(u)$  has an easily identification anti-derivatives then all is well. If not, another substitution method may be needed-

### 2) Integration by Parts-

$$\rightarrow [u(x)v(x)]' = u'(x)v(x) + u(x)v'(x)$$

$$= u(x)v'(x) = [u(x)v(x)]' - u'(x)v(x)$$

$$= \int u(x)v'(x) dx = u(x)v(x) - \int u'(x)v(x) dx$$

$$= \int u dv = uv - \int v du$$

In case of definite integral, we have

$$\int_a^b u(x)v'(x) dx = [u(x)v(x)]_{x=a}^{x=b} - \int_a^b u'(x)v(x) dx$$

### ③ Integrating Rational Function:

②

$$\Rightarrow \frac{3x+2}{2x+3x-3} = \frac{3x+2}{(2x+3)(x-1)}$$

To integrate such a function, we use the method of partial fraction to split the fraction into easily integrable pieces

$$\frac{3x+2}{(2x+3)(x-1)} = \frac{1}{2x+3} + \frac{1}{x-1}$$

$$\text{Now } \int \frac{3x+2}{2x^2+x-3} dx = \frac{1}{2} \log(2x+3) + \log(x-1) + C.$$

Q2) Application of Trapezoidal Rule and Simpson's Rule in Engineering -

(3)

Ans) "Application of Trapezoidal Rule"

- The trapezoidal rule is one of the family members of numerical integration formula.
- The trapezoidal rule has faster convergence.
- Moreover, the trapezoidal rule tends to become extremely accurate than periodic functions.

Application of Simpson's Rule:

- Simpson's Rule is a numerical method for approximating the integral of a function between two limits,  $a$  &  $b$ . It is based on knowing the area under a parabola, or a plane curve.
- It includes the calculation of a vessel's displacement, total wetted surface area, and the calculation of the longitudinal center of buoyancy of the hull.
- It is a weighted average that results in an even more accurate approximation.