

- (b) Using improved Euler's method, find y at $x = 0.1$ and $x = 0.2$ given $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$.
-

MATHEMATICAL METHODS

(For those who joined in July 2006 and after)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

(5 × 20 = 100)

1. (a) (i) Show that $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} = 4 \frac{\partial^2}{\partial z \partial \bar{z}}$. (6)

(ii) Evaluate $\int_C \frac{e^{2z}}{z^2 + 1} dz$ where $|z| = \frac{1}{2}$. (14)

Or

(b) (i) Find the residue of

$$f(z) = \frac{z^3}{(z-1)(z-2)(z-3)}$$
 at each poles.

(8)

(ii) Evaluate $\int_0^{2\pi} \frac{d\theta}{2 + \cos \theta}$. (12)

2. (a) (i) Find the Fourier series for $f(x)$ if

$$\begin{aligned} f(x) &= -\pi, \text{ in } -\pi < x < 0 \\ &= x, \text{ in } 0 < x < \pi. \end{aligned} \quad (14)$$

(ii) Obtain the half range sine series of the function $f(x) = kx(x-l)$ in $0 < x < l$. (6)

Or

(b) (i) Find the Fourier sine transform of $f(x) = e^{-ax}$. (8)

(ii) Using Parseval's identity, calculate

$$\int_0^{\infty} \frac{x^2}{(a^2 + x^2)^2} dx \text{ if } a > 0. \quad (12)$$

3. (a) (i) Find $L[e^{-3t} \sin^2 t]$. (10)

(ii) Find the inverse Laplace transform of $\frac{1}{s(s+3)^3}$. (10)

Or

(b) Using Laplace transform, solve

$$y'' - 3y' + 2y = 4, \text{ given that } y(0) = 2 \text{ and } y'(0) = -3.$$

4. (a) (i) Using iteration method, solve the equation $x^2 - 5x + 2 = 0$. (10)

(ii) Solve the following system of equations by Gauss elimination method.

$$2x + 3y = 5$$

$$3x - y = 2. \quad (10)$$

Or

(b) Solve the following equations by Croust's method.

$$x + y = 2$$

$$2x + 3y = 5.$$

5. (a) (i) Find the value of $\int_1^2 \frac{dx}{x}$ by Simpsons

$$\frac{1}{3} \text{ rule.} \quad (8)$$

(ii) Evaluate $\int_1^2 \frac{dx}{1+x^3}$ using Gauss-3 point formula. (12)

Or

Paper II — MEASUREMENT SYSTEM AND
TRANSDUCERS

(For those who joined in July 2006 and after)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

All questions carry equal marks.

(5 × 20 = 100)

1. (a) Explain in detail, the various types of errors that can occur in a measuring system.

Or

- (b) Draw the block diagram of a measuring system and explain the functions of each block.

2. (a) (i) Derive the generalized mathematical model of measurement system. (12)

- (ii) Write a note on transfer function. (8)

Or

- (b) Discuss the response of a general form of instrument to a periodic input.

3. (a) (i) Explain the working principle and characteristics of strain gauge. (14)
(ii) Write a note on hotwire anemometer.

Or

- (b) Explain the performance of bridge circuits for voltage and current excitation and signal conditioning for dc and ac excitation.

4. (a) Explain the working principle and performance characteristics of linear variable differential transformer (LVDT) with suitable sketches.

Or

- (b) (i) Discuss the frequency response of capacitive transducers. (8)

- (ii) Explain in detail, the applications of transducer. (12)

5. (a) Describe the working principle and loading effects of piezoelectric transducer with suitable diagrams.

Or

- (b) Write notes on :

- (i) aerospace sensor and

- (ii) magneto resistive sensor.

