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B. TECH.
(SEM III) THEORY EXAMINATION 2022-23
MATHEMATICS III

Time: 3 Hours

Total Marks: 70

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 7 = 14

- (a) Define analytic function with an example.
- (b) What is harmonic function?
- (c) Write the normal equation for the curve $y = a + bx + cx^2$
- (d) Write the formula of measure of skewness and kurtosis.
- (e) Write the relation between n^{th} divided difference and n^{th} forward difference.
- (f) Write the formula of trapezoidal rule.
- (g) What do you mean by boundary value problem?

Or

State convolution theorem.

SECTION B

2. Attempt any three of the following:

7 x 3 = 21

- (a) Evaluate $\int_C \frac{z^2+1}{z^2-1} dz$, where C is circle, $|z| = \frac{3}{2}$
- (b) Out of 800 families with 4 children each, Determine the number of families would be expected to have (i) 2 boys and 2 girls (ii) at least one boy (iii) no girl. (Assume probabilities for boys and girls to be equal).
- (c) Apply Newton Raphson's method, find the real root of the equation $3x = \cos x + 1$ correct to four decimal places.
- (d) Solve $5x + 23y + 7z = 37, 11x + y + 23z = 43, 23x + 13y + 3z = 29$ system of equations by Gauss-Seidel method.
- (e) Find the inverse Laplace transform of $f(z) = \frac{z}{(z+2)(z+3)}$

OR

Solve $\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = u(4, t) = 0$, $u_t(x, 0) = 0$ & $u(x, 0) = x(4 - x)$ by taking step length $h=1$

SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

- (a) Expand $\frac{1}{z^2-3z+2}$ in the region
 - a) $|z| < 1$
 - b) $|z| > 2$
 - c) $1 < |z| < 2$
- (b) Using contour integration, evaluate $\int_0^{2\pi} \frac{1}{2+\cos\theta} d\theta$

4. Attempt any **one** part of the following:

7 x 1 = 7

- (a) Fit the straight for the following data:

x	2	3	4	5
y	8	10	12	14

- (b) To test the effectiveness of vaccination against cholera, the following table was obtained:

	Attacked	Not attacked	Total
Vaccinated	30	160	190
Not vaccinated	140	460	600
Total	170	620	790

Test to defend or refute the statement. The vaccination prevents attack from cholera. (Given that χ^2 at 5% level of significance for 1 d.o.f. is 3.841).

5. Attempt any **one** part of the following:

7 x 1 = 7

- (a) Apply Regula falsi method; find the real root of the equation $x^3 - 2x + 3 = 0$ correct upto three decimal places.
- (b) Apply Lagrange interpolation formula to find the value of $y(10)$ from the following table

x	5	6	9	11
y	12	13	14	16

6. Attempt any **one** part of the following:

7 x 1 = 7

- (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$, using Simpson's one- third rule by taking 6 intervals.
- (b) Use Runge Kutta method of fourth order to approximate y when $x = 3$ given that $y(0) = 5$ and $\frac{dy}{dx} = 3e^{-x} - 0.4y$, using $h = 1.5$

7. Attempt any **one** part of the following:

7 x 1 = 7

- (a) Solve $\frac{d^2y}{dx^2} + y = 0$; $y(0) = 0, y(1) = 1, h = 0.25$ by finite difference method.
- (b) Determine the Fourier cosine transform of $\frac{1}{1+x^2}$ and hence find Fourier sine transform of $\frac{x}{1+x^2}$.