Code: 9ABS105 **R09**

B.Tech I Year (R09) Supplementary Examinations December/January 2015/2016

MATHEMATICAL METHODS

(Common to CSE, ECE, EEE, EIE, ECM, E.Con.E, IT & CSS)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 Verify Cayley Hamilton theorem for the matrix A = $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ and hence find A^{-1} .

2 Reduce the quadratic form $3x_1^2 + 3x_2^2 + 3x_3^2 + 2x_1x_2 + 2x_1x_3 - 2x_2x_3$ to canonical form by orthogonal transformation and hence find the rank, index, signature and nature of the quadratic form.

3 (a) Use Largrange formula to calculate *f*(3) from the following table.

x	0	1	2	4	5	6
f(x)	1	14	15	5	6	19

(b) Find a real root of $f(x) = x^3 - 4x - 9 = 0$ by bisection method.

4 Evaluate $\int_0^1 \sqrt{1+x4}\, dx$ using Simpson's $\frac{3}{8}$ rule.

5 Use Runge-Kutta method of 4th order to solve $\frac{dy}{dx} = 1 + y^2, y(0) = 0$ on the interval $0 \le x \le 0.5$ with $h = 0.1$.

6 (a) Expand $f(x) = x \sin x$,in $0 < x < 2\pi$ as a Fourier series.

(b) If $F(s)$ is the complex Fourier transform of f(x), then prove that $F\{f(ax)\} = \frac{1}{a} F\left(\frac{s}{a}\right), a \neq 0.$

7 A homogeneous rod of conducting the material of length 100 cm has its ends kept at zero Temperature and the temperature initially is $u(x,0) = \begin{cases} x, & 0 \le x \le 50 \\ 100 - x, & 50 \le x \le 100 \end{cases}$. Find the temperature $u(x,t)$ at any time.

8 (a) If $Z(u_n) = \overline{u}(z)$, Prove that $Z(u_{n+k}) = z^k \left[\overline{u}(z) - u_0 - u_1 z^{-1} - u_2 z^{-2} - \cdots - u_{k-1} z^{-(k-1)}\right]$.

(b) Solve the difference equation $u_{n+2} + 2u_{n+1} + u_n = n$ given that $u_0 = 0, u_1 = 0$, using Z-transforms.

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