Code No: Z0224/R07 **Set No. 1**

I B.Tech Supplementary Examinations, January 2014
MATHEMATICAL METHODS
(Common to Electrical & Electronics Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering, Production Engineering, Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Express the following system in matrix form and solve by Gauss elimination method.
   $2x_1 + x_2 + 2x_3 + x_4 = 6$; $6x_1 - 6x_2 + 6x_3 + 12x_4 = 36$,
   $4x_1 + 3x_2 + 3x_3 - 3x_4 = -1$; $2x_1 + 2x_2 - x_3 + x_4 = 10$.
   (b) Show that the system of equations $3x + 3y + 2z = 1$; $x + 2y = 4$; $10y + 3z = -2$; $2x - 3y - z = 5$ is consistent and hence solve it. [8+8]

2. A square matrix A is defined by $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$. Find the modal matrix P and the resulting diagonal matrix D of A. [16]

3. Find the rank and index of the quadratic forms and reduce it to canonical form $3x^2+5y^2+6z^2-2xy+2xz-2yz$

4. (a) Given $u_1 = 22$, $u_2 = 30$, $u_4 = 82$, $u_7 = 106$, $u_8 = 206$, find u_6. Use Lagrange's interpolation formula.
   (b) Find a real root of $x^3-x-2=0$. [8+8]

5. (a) Find the best fitting straight line to the data:

x:	0	5	10	15	20	25	30
y:	10	14	19	25	31	36	39

   (b) Evaluate $\int_0^4 e^x dx$ using trapezoidal and Simpson's rule. Also compare your result with the exact value of the integral. [8+8]

6. Obtain y(0.6) and y(0.8) given y'= x+y, y(0) = 1 with h=0.2 by Adam's method. [16]

7. (a) Expand $f(x)= x^2$ in $(-\pi, \pi)$ as a Fourier series and deduce the relations
   i. $1+ \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{6}$.
   ii. $1- \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots = \frac{\pi^2}{12}$.

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(b) Obtain the Fourier series expansion of f(x) given that f(x) = 1-x in $-1 < x < 1$ and deduce the value of $\frac{1}{1} - \frac{1}{3} + \frac{1}{5} -$ ..... [8+8]

8. (a) Find Z $^{-1}$ $\left(\frac{z^2-3z}{(z+2)(z-5)}\right)$

(b) Solve y^2p-xyq=x(z-2y). [8+8]

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Code No: Z0224/R07 **Set No. 2**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Use matrix method to solve the equations 2x-y+3z=9, x+y+z=6, x-y+z=2.
   (b) Test for the consistency of the following system of equations and solve (if consistent) x+2y+z=4, 5x+8y+z=14. [8+8]

2. Using Cayley-Hamilton relation obtain the inverse of the matrix $\begin{bmatrix} 1 & 2 & 4 \\ 2 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$ [16]

3. Reduce the quadratic form $3x^2 - 2y^2 - z^2 + 12yz + 8zx - 4xy$ to canonical form by an orthogonal reduction and state the nature of the quadratic form. [16]

4. (a) Solve $e^x - 3x = 0$ by the method of iteration.
   (b) Using Newton-Raphson method, find a positive root of $x^3 - x - 1 = 0$. [8+8]

5. (a) It is known that x, y are related by $y = \frac{a}{x} + bx$ and the experimental values are given below:

x:	1	2	4	6	8
y:	5.43	6.28	10.32	14.86	19.5

   Obtain the best values of a and b.

   (b) Find the first two derivatives of the function tabulated below at x=0.6

x:	0.4	0.5	0.6	0.7	0.8
y:	1.5836	1.7974	2.0442	2.3275	2.6511

   [8+8]

6. Solve numerically using Euler's method and Taylor's method $y' = (x^3 + xy^2)/e^x$ given that y(0) = 1. Find y(0.1), y(0.2) and y(0.3). [16]

7. (a) Expand $f(x) = \begin{cases} 1; & 0 < x < \pi \\ 0; & \pi < x < 2\pi \end{cases}$

   as a Fourier series.

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(b) Obtain the Fourier series expansion of f(x) given that $f(x) = \begin{cases} 1; & 0 < x < 1 \\ 2; & 1 < x < 3 \end{cases}$ and f(x)=3/2 when x=0, 1, 3 and f(x+3)=f(x) for all x. [8+8]

8. (a) Solve $x^4p^2 + y^2zq = 2z^2$

(b) Find the inverse Z-transform of $\frac{(z^2-1)z}{(z^2+1)^2}$ using residues. [8+8]

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Code No: Z0224/R07 **Set No. 3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find the rank of $\begin{pmatrix} 1 & 3 & 2 & 5 & 1 \\ 2 & 2 & -1 & 6 & 3 \\ 1 & 1 & 2 & 3 & -1 \\ 0 & 2 & 5 & 2 & -3 \end{pmatrix}$

   (b) Solve completely the system of equations
   $4x + 2y + z + 3u = 0$, $6x + 3y + 4z + 7u = 0$, $2x + y + u = 0$. [8+8]

2. (a) Determine the eigen values and eigen vectors of the matrix A= $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

   (b) If A = $\begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$, find A^{100} [8+8]

3. Find the transformation that will transform $10x^2+2y^2+5z^2+6yz - 10zx - 4xy$ into a sum of square and find its reduced form. [16]

4. (a) Find a positive root of $3x - \sqrt{1 + \sin x} = 0$ by iteration method.

   (b) If y = (3x + 1)(3x + 4).....(3x + 22), prove that
   $\Delta^4 y = 136080$ (3x + 13)
   (3x + 16)(3x + 19)(3x + 22). [8+8]

5. (a) Fit a parabola to the data given below

x:	1	2	3	4	5
y:	10	12	8	10	14

   (b) For the table below:
   find f' (1.76) and f' (1.72).

x:	1.72	1.73	1.74	1.75	1.76
f(x)	0.17907	0.17728	0.17552	0.17377	0.17204

   [8+8]

6. (a) Using Taylor series method obtain the values of y at x=0.2 and x=0.4 correct to 4 decimal places, if y satifies the equation $\frac{d^2y}{dx^2} = xy$ given that y'= 1 and y=1 when x=0.

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(b) Find y for x=0.2, 0.4 given $\frac{dy}{dx} = 1 + y^2$, y(0)=0. [8+8]

7. (a) Expand $f(x) = \begin{cases} x; & 0 < x < \pi \\ 2\pi - x; & \pi < x < 2\pi \end{cases}$
as a Fourier series of periodicity 2π, and deduce the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots = \frac{\pi^2}{6}$.

(b) Expand f(x)= -1, in (-2,0) and f(x)=1, in (0,2) as a Fourier series. [8+8]

8. (a) Solve the difference equation, using Z-transform y(k+2)+2y(k+1)+y(k)=u(k), where y(0)=0, y(1)=0 and u(k)=k for k=0,1,2,.....

(b) Solve $x^2(z-y)p + y^2(x-z)q = z^2(y-x)$ [8+8]

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Code No: Z0224/R07 **Set No. 4**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Solve the system of the equations: 5x+3y+3z=48; 2x+6y-3z=18; 8x-3y+2z=21.
   (b) Test for consistency and hence solve x + 5y + 7z = 15, 2x + 3y + 4z = 11, x - 2y -3z = -4, 3x + 11y + 13z = 25. [8+8]

2. (a) Find the characteristic equation of the matrix $A = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ Hence find A^{-1}.
   (b) Prove that $\sin^2 A + \cos^2 A = 1$ where $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ [8+8]

3. Reduce the quadratic form $3x^2+5y^2+3z^2-2yz+2zx-2xy$ to the canonical form and specify the matrix of transformation. [16]

4. (a) Solve for a positive root of $x^3 - 4x + 1 = 0$ by Regula Falsi method.
   (b) Represent the function $f(x) = x^4 - 12x^3 + 42x^2 - 30x + 9$ and its successive differences in factorial notation in which the interval of differencing is one. [8+8]

5. (a) Fit a curve $y=ae^{bx}$ to the data by the method of least squares:

x:	0	2	4
y:	5.012	10	31.62

   (b) Compute $\int_0^4 e^x dx$ by Simpson's one-third rule with 10 subdivisions. [8+8]

6. (a) Obtain y(0.25) and y(0.5) given $y' = \frac{x^2}{1+y^2}$ y(0) = 0 by Picard's method.
   (b) Apply Taylor's method to obtain the approximate value of y at x=0.2 for $y' = 2y+3e^x$, y(0)=0. [8+8]

7. (a) Obtain the Fourier series expansion of f(x) given that f(x) = kx(π-x) in $0<x<2\pi$ where k is a constant.

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(b) Find the Fourier series of peridiocity 3 for f(x) = 2x-x^2 , in 0<x<3. [8+8]

8. (a) Form the partial differential equation by eliminating f(x^2+y^2,2xy)=0.
(b) Solve the difference equation, using Z-transform x(k)-ax(k-1)=u(n). [8+8]

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