

Code No: A109210201

R09**Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

MATHEMATICS-III

Common to ICE, E.COMP.E, ETM, EIE, ECE, EEE

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

- Express x^3+3x^2+4x+3 in terms of Legendre polynomial.
 - Evaluate $\int_0^1 x(1-x^2)^{-\frac{1}{2}}U_4(x)dx$. [8+7]
- Find the Taylor's and Laurent's series which represents the function $\frac{(z^2-1)}{(z+3)(z+2)}$ when
 - $|z| \leq 2$
 - $2 < |z| < 3$
 - $|z| \geq 3$ [15]
- Find the analytic function $f(z) = u(r, \theta) + i v(r, \theta)$ such that $u(r, \theta) = r^2 \cos 2\theta - r \cos \theta + 2$.
 - S.T. The function $u = 1/2 \log(x^2 + y^2)$ is harmonic & find its conjugate. [15]
- Evaluate $\int_0^{\infty} \frac{\log x}{1+x^2} dx$
 - Find the Residues of $f(z) = \frac{1}{z(e^z-1)}$ [8+7]
- Evaluate $\int_C (z^2 + 3z + 2)dz$ where C is the arc of the cycloid $x=a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ between the points (0,0) & $(a\pi, 2a)$
 - Evaluate $\int_C (z^2 + 3z)dz$ along the straight line from (2,0) to (2,2) and then from (2,2) to (0,2) [15]
- Draw the undirected graph represented by the adjacency matrix A given below.

$$A = \begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$
 - Convert the following tree into binary tree (figure 1). [7+8]
- Using Jacobi Series, P.T. $J_0^2 + 2\{J_1^2 + J_2^2 + \dots\} = 1$ [15]
- Find the points at which $w = \cosh z$ is not conformal.
 - Find the image of the strip bounded by $x = 0$ and $x = \frac{\pi}{4}$ under the transformation $w = \cos z$ [7+8]

Code No: A109210201

R09

Set No. 2

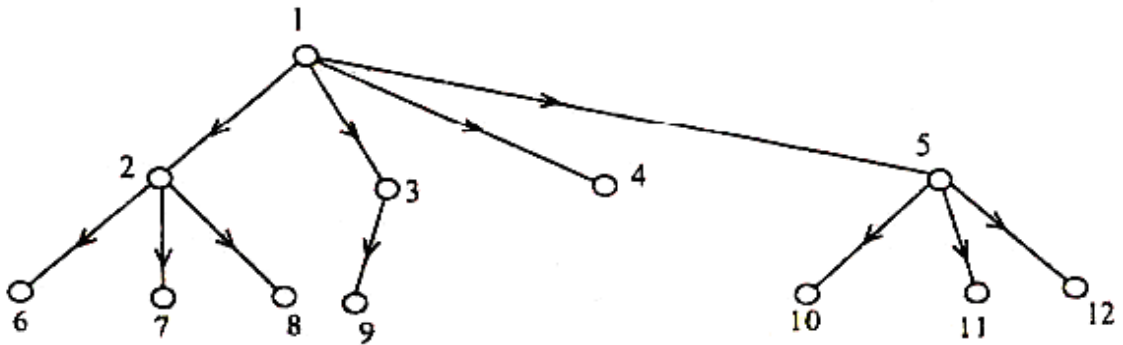


Figure – 1

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Code No: A109210201

R09

Set No. 4

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- Find the bilinear transformation which maps $z_1 = 1, z_2 = i, z_3 = -1$ in to the points $w_1 = i, w_2 = 0, w_3 = -i$ respectively. Find the fixed and critical points of this transformation and find the image of $|z| < 1$ [15]
- (a) Show that when $|z + 1| < 1$, $z^{-2} = 1 + \sum_{n=1}^{\infty} (n+1)z^n$
(b) Find the Laurent series expansion of $f(z) = \frac{z^2 - 6z - 1}{(z-1)(z-3)(z+2)}$ in the region $3 < |z + 2| < 5$. [7+8]
- (a) S.T. $J_3(x)$ is an even function when 'n' is even & odd function when 'on' is odd.
(b) Evaluate $\int_0^{\alpha} x^{-3/2}(1 - e^{-x})dx$ or $\int_0^{\alpha} t^{-3/2}(1 - e^{-t})dt$ [15]
- (a) Evaluate contour integral of the real integral $\int_0^{2\pi} \frac{\cos 3\theta d\theta}{5 - 4 \cos \theta}$
(b) The only singularities of a single valued function $f(z)$ are poles of order 1 and 2 at $z = -1$ and $z = 2$ with residues at these poles i and 2 respectively. If $f(0) = \frac{7}{4}$, $f(1) = \frac{5}{4}$, determine the function $f(z)$. [8+7]
- (a) Verify whether the graph G given below Figure 2 contain an Eulerian circuit.

Code No: A109210201

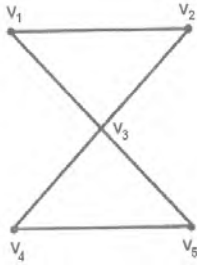
R09**Set No. 4**

Figure 2:

- (b) Using D F S (Depth first search) to produce a spanning tree for the simple graph Figure 3. [7+8]

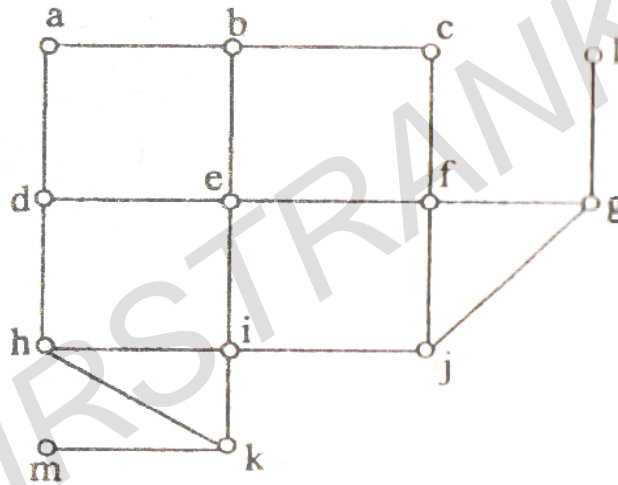


Figure 3:

6. (a) S.T. the real & imaginary parts of the function $w = \log z$ satisfy the C-R equations when z is not zero.
 (b) S.T. $f(z) = z + 2\bar{z}$ is not analytic anywhere in the complex plane. [15]
7. Let 'C' denotes the boundary of the square whose sides lie along the lines $x = \pm 2$, $y = \pm 2$ where 'C' is described in the positive sense evaluate the following integrals
 (a) $\int_C \frac{\tan(z/2)}{(z-x_0)^2} dx$ ($|x_0| < 2$)
 (b) $\int_C \frac{\cosh z}{z^4} dz$ [15]
8. P.T. $\frac{1}{\sqrt{1-2xt+t^2}} = P_0(x) + P_1(x)t + P_2(x)t^2 + \dots$ [15]

Code No: A109210201

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1. (a) Find the image of the triangle with vertices at $i, 1+i, 1-i$ in the z -plane, under the transformation $e^{\frac{5\pi i}{3}} \cdot (z - 2 + 4i)$
- (b) Find the image of the infinite strip, $0 < y < \frac{1}{2}$ under the mapping function $w = \frac{1}{z}$. [7+8]
2. (a) Find the residue of $\frac{\cos(z-i)}{(z+2i)^3}$.
- (b) Evaluate $\int \frac{\sin z dz}{z \cos z}$ where c is $|z| = \pi$. [8+7]
3. (a) Evaluate $\int_C (y^2 + 2xy)dx + (x^2 - 2xy)dy$ where 'C' is the boundary of the region by $y = x^2$ & $x = y^2$
- (b) Evaluate $\int_0^{1+i} z^2 dz$ along $y = x^2$ [15]
4. (a) S.T. an analytic function of constant absolute value is constant.
- (b) S.T. both the real & imaginary parts of an analytic function are harmonic. [15]
5. (a) P.T. $\frac{d}{dx} \{x^n J_n(x)\} = x^n J_{n-1}(x)$
- (b) S.T. $4J_n^{11}(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$ [15]
6. (a) S.T. $\int_0^1 x^2 P_{n+1}(x) P_{n-1}(x) dx = \frac{2n(n+1)}{(4n^2-1)(2n+3)}$
- (b) S.T. $2P_3(x) + 3P_1(x) = 5x^3$ [15]
7. Find the minimal spanning tree for the following Graph (Figure 4). [15]
8. Expand $f(z) = \frac{z+3}{z(z^2-z-2)}$ in powers of z .
 - (a) Within the unit circle about the origin
 - (b) Within the annular region between the concentric circles about the origin having radii 1 and 2 respectively.
 - (c) The exterior to the circle of radius 2. [15]

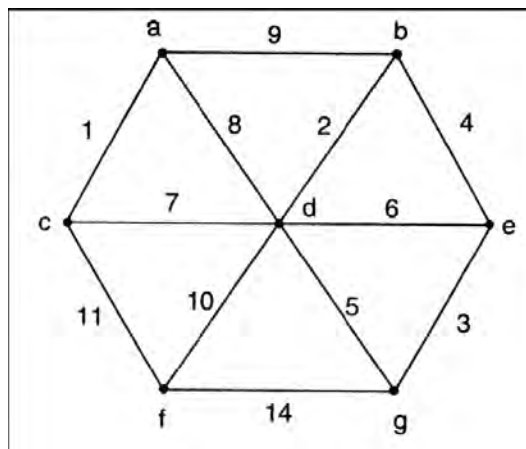


Figure - 4

Code No: A109210201

R09

Set No. 3

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MATHEMATICS-III

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Time: 3 hours

Max Marks: 75

Answer any FIVE Questions

All Questions carry equal marks

1. Expand the function $f(z) = \frac{4z+4}{z(z-3)(z+2)}$ in powers of z , when
- $|z| \leq 1$
 - $1 \leq |z| \leq 2$
 - $|z| > 2$ [15]
2. (a) Show that the transformation $w = \frac{3-z}{z-2}$ transforms the circle $|z - \frac{5}{2}| = \frac{1}{2}$ in the z -plane into the imaginary axis in the w -plane.
 (b) For the mapping $w = 1/z$, find the image of the family of circles $x^2 + y^2 = ax$, where a is real. [8+7]
3. (a) Determine the value of $J_{1/2}(x)$
 (b) P.T. $\int_0^{\pi/2} \sin^7 \theta \cos^7 \theta d\theta = \frac{1}{280}$ [15]
4. (a) Find 'k' such that $f(x,y) = x^3 + 3kxy^2$ may be harmonic & find its conjugate.
 (b) Find the conjugate harmonic of $u = e^{x^2-y^2} \cos 2xy$. Hence find $f(z)$ in terms of 'z'. [15]
5. (a) Find whether the following (figure 5) is a binary tree.
 (b) Suppose all vertices in a graph have odd degree 'K'. Show that total number of edges in G is multiple of K. [8+7]
6. If $P_6(2) = a$ & $P_7(2) = b$, then P.T. [15]
- $P_6^1(2) = \frac{7}{3}(b - 2a)$
 - $P_8(2) = \frac{1}{8}(30b - 7a)$

Code No: A109210201

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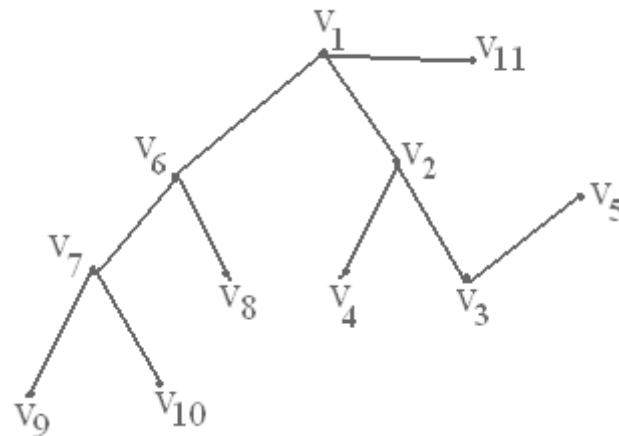


Figure 5:

7. (a) Using complex variable techniques evaluate $\int_0^{2\pi} \frac{\sin^2 \theta d\theta}{5-4 \cos \theta}$.
- (b) The only singularities of a single valued function $f(z)$ are poles of order 2 and 1 at $z=1$ & $z=2$ with residues of these poles as 1 and 3 respectively. If $f(0) = \frac{3}{2}$, $f(-1) = 1$, determine the function. [8+7]
8. (a) From the integral $\int_0^{\pi} \frac{dz}{z+4}$ S.T $\int_0^{\pi} \frac{1+4 \cos \theta}{17+8 \cos \theta} = 0$ where $C: |z|=1$
- (b) If C is a closed curve described in +ve sense and $f(z_0) = \int_C \frac{z^4+z}{(z-z_0)^4} dz$ show that $f(z_0) = 8\pi i z_0$ is where z_0 is a point inside 'C' and $f(z_0) = 0$ if z_0 lies outside 'C'. [15]
