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CS/M.TECH (EE)/SEM-1/EAM-101/2010-11 2010-11

ADVANCED ENGINEERING MATHEMATICS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any four from the rest questions.

1. i) Show that $\log z$ is analytic anywhere except at (0, 0).

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- ii) Convert $\int_{0}^{2\pi} \frac{d\phi}{a^2 + \sin^2 \phi}$ into an equivalent complex
 - integral. 2
- iii) Show that λ^m is e-val of A_{nxn} where λ is the eigenvalue of A_{nxn} ; $m \,\square\, N$.
- iv) Find co-ordinates of (0, 3, 1) with respect to the vectors (1, 1, 0), (1, 0, 1), (0, 1, 1).
- v) Find critical points of $w = e^{2z} 2iz + 3$.
- vi) Explain *N-R* method geometrically. 3

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- 2. a) State and prove Morera's Theorem.
 - b) Evaluate $\int \frac{e^{2z}}{(z+1)^3} dz$ where c is the ellipse

$$x^2 + y^2 = 9.$$

- 3. a) If f'(z) has a n-fold zero at $z = z_0$ then show that the angles after transformation are multiplied by (n + 1).
 - b) Show that Laplace's Equation is preserved under conformal transformation.
- 4. a) Obtain the equation to the curve y = f(x) giving the minimum surface of revolution about *X*-axis. 7
 - b) Show that Euler-Lagrange equation can be put in the form :

$$1/y \left[\frac{d}{dx} \left(F - \hat{y} \ \partial F \ / \ \partial \hat{y} \ \right) - \ \partial F \ / \ \partial x \, \right] = 0. \eqno 7$$

5. a) State and prove Caley Hamilton theorem and verify it for the matrix:

$$\{0\ 0\ 1;\ 3\ 1\ 0;\ -2\ 1\ 4\}.$$

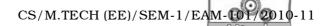
- b) Show that the eigenvalues of a symmetric matrix are all real. 6
- 6. a) A top open rectangular box has capacity 32 cubic ft. Find the dimension of the box so that the total surface is minimum.
 - b) Find all extreme values of the function:

$$x^3 + y^3 - 3x - 12y + 20.$$

Find also the saddle points.

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7. a) Find whether the set and vectors.

$$S = \{ (1, 2, -1, 3), (3, -1, 2, 1), (2, -2, 3, 2), (1, -1, 1, -1) \}^{\top}$$

is linearly dependent. Find a subset of S which is linearly independent.

- b) Show that $S = \{ (x, y, z) : x^2 + y^2 = z^2 \}$ is not a subspace of \mathbb{R}_3 (\mathbb{R}).
- 8. a) Solve the equation using Gauss-Seidel method: 9

$$28x + 4y - z = 32$$

$$x + 3y + 10z = 24$$

$$2x + 17y + 4z = 35.$$

b) Find the smallest positive root of the equation: 5

$$e^x = 4 \sin x$$

Correct upto 4 decimal places by bisection method.