	Utech
Name:	
Roll No.:	A Grant of Execution 2nd Explored
Invigilator's Signature :	

CS/M.TECH(EE)/SEM-1/EMM-101/2011-12 2011

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 any five questions $5 \times 14 = 70$

- 1. a) Determine and graph the image of |z-a|=a under the transformation $w=z^2$. 5+2
 - b) Show that the transformation $w = \frac{5-4z}{4z-2}$ transform the circle |z| = 1 into a circle of radius unity in the w-plane and find he centre of the circle. 6+1
- 2. a) Evaluate $\int |z|^2 dz$ where c is the square with c

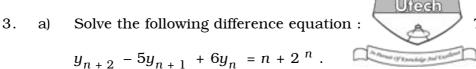
vartices at (0,0), (1,0), (1,1), (0,1).

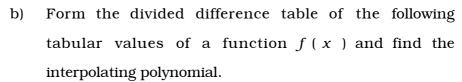
- b) Evaluate $\oint_C \frac{1}{z^2 + 9} dz$ where c is |z 3i| = 4.
- c) Prove that $\frac{1}{2\pi i} \int_{C} \frac{e^{zt}}{z^2 + 1} dz = \sin t$,

where t > 0 and c is the circle $|z| = \pi$.

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х	- 2	- 1	0	1	2	3
f(x)	70	11	4	1	2	55

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4. a) Solve the following system of equations, correct to 3 decimal places, by Newton-Rephson method with (0,0) as initial app[roximation:

$$x^{3} + y^{3} - 6x + 3 = 0$$

 $x^{3} - y^{3} - 6y + 2 = 0.$

b) By using LU decomposition method, solve the following system:

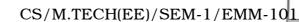
$$2x + y + z = 3$$
$$x + 3x + z = -2$$
$$x + y + 4z = -6.$$

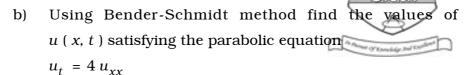
5. a) Use Adams' predictor-corrector method to obtain the solution of the equation

$$\frac{dy}{dx} = x^2 + y^2$$
 at $x = 1.4$,

given that y (1) = 0, y (1·1) = 0·11072, y (1·2) = 0·24631, y (1·3) = 0·41357.

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subject to

boundary conditions u (0, t) = 0 = u (8, t) and initial condition (x, 0) = $4x - \frac{1}{2} x^2$

at the points x = i where i = 0, 1, 2,, 7 and $t = \frac{j}{8}$, j = 0, 1, 2, 5.

- 6. a) Find the curve c passing through two given points $A(x_1, y_1)$ and $B(x_2, y_2)$ such that the rotation of the curve c about x-axis generates a surface of revolution having minimum surface area.
 - b) Find the extremal of the following functional : $\int_{0}^{\pi/2} (y'^2 y^2 + 2xy) dy; y(0) = 0, y(\frac{\pi}{2}) = 0.$
- 7. a) Use Bellman's principle of optimality to minimize $z=y_1+y_2+\ldots\ldots+y_n \text{ , subject to the constraint:}$ $y_1\cdot y_2\cdot\ldots y_n=d.$ 7
 - b) Show that the system of equations:

$$x + 2y - z = 3$$
$$3x - y + 2z = 1$$
$$2x - 2y + 3z = 2$$
$$x - y + z = -1$$

is consistent and solve it.

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8. a) Let V and W be vector spaces over a field F and V is finite dimensional. If $T:V\to W$ be a linear mapping, then prove that

rank of T + nullity of T = dim V.

b) Let { α_1 = (1, 1, 1), α_2 = (0, 1, 1), α_3 = (0, 0, 1) } be a basis of the Euclidean space V_3 (R). Use Gram-Schmidt process of orthogonalisation to obtain an orthonormal basis from { α_i }.

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