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B.TECH. IIIrd SEMESTER EXAMINATION 2013-14
Engineering Mathematics-III(TMA-301)
CE/EE/ME

Time: 03 Hour

Total Marks: 100

Note: Attempt ALL the questions.

1. Attempt any four:

(4x5=20)

(a) Find out the zeros and discuss the nature of the singularities of

$$f(z) = \frac{z-2}{z^2} \sin\left(\frac{1}{z-1}\right)$$

(b) Find the missing term in the following table:

x	45	50	55	60	65
y	3	-	2	-	-2.4

(c) If $w = u + iv$ and $u - v = e^x(\cos y - \sin y)$, find the value of w in terms of z .

(d) By Newton-Raphson method, find the value of $(48)^{1/3}$.

(e)(i) Prove that $1 + \frac{\delta^2}{2} = \sqrt{1 + \delta^2 \mu^2}$,

(ii) Obtain the function whose first difference is $9x^2 + 11x + 5$

(f) Prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |Rf(z)|^2 = 2|f'(z)|^2$

2. Attempt any four:

(4x5=20)

(a) By Cauchy residue theorem solve the integral

$$\oint_C \frac{3z^2 + 2 + 1}{(z^2 - 1)(z + 3)} dz \quad \text{where } C: |z| = 2$$

(b) If

$$f(z) = \frac{z^3 y(y-ix)}{x^6 + y^2}, z \neq 0; f(0) =$$

0 then prove that $\frac{f(z)-f(0)}{z} \rightarrow 0$ as $z \rightarrow 0$

along any radius vector but not as $z \rightarrow 0$ in any manner and also that $f(z)$ is not analytic at $z = 0$.

(c) Find the Laurent's expansion for

$$f(z) = \frac{7z-2}{z^3-z^2-2z}, \text{ in the region } 1 < |z+1| < 3$$

(d) Determine the value of p and q so that rate of convergence of the iterative method $x_{n+1} = px_n + q \frac{N}{x_n^2}$ for computing $N^{1/3}$ becomes as high as possible.

(e) The following table is given:

x	0	1	2	5
y	2	3	12	147

What is the form of the function?

(f) If u is harmonic function then show that $w=u^2$ is not harmonic function unless u is a constant.

3. Attempt any two.

(2x10=20)

(a) Solve the following system of equations by Gauss-Seidel iterative method: $27x + 6y - z = 85,$

$$6x + 15y + 2z = 72,$$

$$x + y = 54z = 110$$

(b) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution. It is given that if $\frac{1}{\sqrt{2\pi}} \int_0^t e^{-x^2/2} dx$ then $f(0.5)=0.19$ and $f(1.4)=0.42$

(c) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time t (in seconds):

t	0	0.2	0.4	0.6	0.8	1	1.2
θ	0	0.12	0.49	1.12	2.02	3.2	4.67

4. Attempt any two:

(2x10=20)

(a) A quality control engineer of a tyre company collected the following data. For each of 12 batches of 1000 tyres, he tested 5 tyres and recorded the following results with \bar{x} and R measured in thousands of kilometers:

Batch	1	2	3	4	5	6	7	8	9	10	11	12
\bar{x}	51.5	49.7	50	50.7	50.7	50.6	49.8	51.1	50.2	50.4	50.6	50.7
R	1.5	1.6	1.8	0.1	0.9	2.1	0.3	0.8	2.3	1.3	2	2.1

Draw the control chart. Is the production process in control? Explain.

(b) State & prove Simpson's 3/8th rule with the help of quadrature formula and discuss its nature.

(c) Use Runge-Kutta formula of fourth order to find the numerical solution at $x=0.8$ for the differential equation $y' = \sqrt{x+y}, y(0.4) = 0.41$, assume the step length $h = 0.2$

5. Attempt any two:

(2x10=20)

(a) Use contour integration to evaluate the real integral

$$\int_0^{\infty} \frac{\cos mx}{x^2 + a^2} dx; (m \geq 0, a > 0)$$

(b) Find the root of the equation $xe^x = \cos x$ in the interval $(0,1)$ using Regula-falsi method correct upto four decimal places.

(c) In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible: Variance of $x=9$. Regression lines $8x-10y+66=0, 40x-18y-214=0$. Calculate: (i) The mean value of x and y . (ii) The standard deviation of y and (iii) The coefficient of correction $b/w x$ and y