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TMA-301(A)

B. Tech. (ME) (Third Semester)
End Semester EXAMINATION, 2017
ENGINEERING MATHEMATICS—III

Time : Three Hours] [Maximum Marks : 100

Note : (i) This question paper contains *five* questions.

(ii) All questions are compulsory.

(iii) Instructions on how to attempt a question are mentioned against it.

(iv) Total marks assigned to each question are **twenty**.

1. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Show that the function $z|z|$ is harmonic not analytic anywhere.

(b) Show that the function $f(z)$ is defined by :

$$f(z) = \begin{cases} e^{-z^4}, & z \neq 0 \\ 0, & z = 0 \end{cases}$$

is not analytic at the origin even though it satisfies Cauchy-Riemann equation at the origin.

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- (c) Prove that $u = x^4 + y^4 - 6x^2y^2$ is harmonic. Also find analytic function $f(z) = u + iv$ in terms of z .

2. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

- (a) Evaluate :

$$\int_C \frac{e^{2z} + z^2}{(z-1)^5} dz,$$

where C is the circle $|z| = 2$.

- (b) Show that the relation $w = \frac{5-4z}{4z-2}$ transforms the circle $|z| = 1$ into a circle of radius unity in the w -plane and find the centre of this circle.

- (c) Evaluate the integral :

$$\int_0^{2\pi} \frac{\cos 3\theta}{5-4\cos\theta} d\theta$$

3. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

- (a) Construct the forward difference table for the data below, evaluate $\Delta^2 f(10)$ and $\Delta^4 f(5)$:

x	$F(x)$
5	9962
10	9848
15	9659
20	9397
25	9063
30	8660

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- (b) Find the cubic Lagrange's interpolation formula from the following data :

x	$F(x)$
0	2
1	3
2	12
5	147

- (c) Compute the value of π from the formula

$$\frac{\pi}{4} = \int_0^1 \frac{dx}{1+x^2} \text{ by using Trapezoidal rule with } h = 1/4.$$

4. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

- (a) Use Taylor's series method to solve the equation $y' = x^2 + y^2$ for $x = 0.5$ given $y(0) = 1$.

- (b) Find the second derivative of $y = f(x)$ at $x = 1.5$ from the data given :

X	Y
1.5	3.375
2.0	7.0
2.5	13.625
3.0	24.0
3.5	38.875
4.0	59.0

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- (c) Using Runge-Kutta fourth order method compute $y(0.1)$ from :

$$10 \frac{dy}{dx} = x^2 + y^2, y(0) = 1,$$

taking $h = 0.1$.

5. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

- (a) In a bolt factory, machines A, B and C manufacture respectively 25%, 35%, 40% of the total of their output. 5%, 4%, 2% are defective bolts. A bolt is drawn at from the product and is found to be defective. What are the probability that is was manufactured by machines A, B and C ?

- (b) Obtain the line of regression of y on x from the following data :

x	y
1.53	33.50
1.78	36.30
2.60	40.00
2.95	45.80
3.42	53.50

- (c) Define Moment Generating Function (MGF) and find the MGF of discrete Poisson distribution.