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CS/M.TECH (ECE)/SEM-1/MCE-101/2012-13 2012

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.

- 1. a) Find the critical point of the function f(x, y) = xy. 2
 - b) Show that another form of Euler-Lagrange equation is $d/dx [f-y^{\dagger} \partial f / \partial y^{\dagger}] \partial f / \partial x = 0.$ 3
 - c) Evaluate $\int_{C} \sin 6 z / (z \pi/6)^3 dz$, if C: |z| = 1.

d) Find the Laurents Expansion for

$$f(z) = (z-2)(z+2)/(z+1)(z+4),$$

when $1 < |z| < 4.$

e) If A and B are two mutually independent events then show that A^{T} and B^{T} are also mutually independent.

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- 2. a) State and prove Bayes' theorem.
 - b) In a bolt factory, machines *A*, *B*, *C* manufacture 25, 35 and 40 per cent of the total respectively. Of this output 5, 4 and 2 per cent are defective bolts. A bolt is drawn at random from the product and is found defective. What is the probability that it was manufactured by *C*?

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- 3. a) Show that the shortest wave joining two fixed points is a straight line.
 - b) If f(z) be analytic within and on a simple closed contour C, then the point giving the maximum of the |f(z)| can be on the boundary c and within it prove that.
- 4. a) Use Runge's method to find an appropriate value of y when x = 0.8 given that

$$dy / dx = (x + y)^{1/2}$$
 when $y(0.4) = 0.41$.

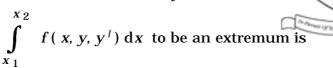
- b) Given $dy/dx = x^2 (1 + y)$ and y (1) = 1, y (1.1) = 1.233, y (1.2) = 1.548, y (1.3) = 1.979, Evaluate y (1.4) by Milne's predictor corrector method.
- 5. a) Find the optimum value of $f(x, y) = x^2 y^2$ subject to the condition x + y = 1 using Lagrange's multiplier method.
 - b) Show that, if f(z) is continuous function in a simply connected domain D and if $\int_c f(z) dz = 0$, where c is any rectifiable closed Jordon curve in D then f(z) is analytic in D.

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6. a) Show that the necessary condition for



$$\partial f/\partial y - \mathbf{d}/\mathbf{d}x (\partial f/\partial y^{T}) = \mathbf{0}.$$

- b) Find the mean and variance of binomial distribution having parameters n and p.
- 7. a) Find the extremals of the following functionals

i)
$$\int_{x_0}^{x_1} (x + y^{l}) y^{l} dx$$

ii)
$$\int_{x_0}^{x_1} (y^{1/2} / x^3) dx.$$
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b) Solve the following difference equations :

i)
$$(\Delta^2 - 3\Delta + 2)y_x = 0$$

ii)
$$U_{n+3} - 3 U_{n+2} + 4 U_n = 0.$$
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8. a) Evaluate $\int_{0}^{2\pi} e^{-\cos\theta} (\cos(n\theta + \sin\theta)) d\theta$ where n

is a positive integer.

b) If $f(z) \to 0$ uniformly as $|z| \to \infty$ and f(z) is meromorphic in the upper half plane then show that

$$\underset{R \to \infty}{Lt} \int_{c_R} e^{imz} f(z) dz = 0 (m > 0)$$

where CR denotes semicircle |z| = R, I(z) > 0.

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