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BT-3/D-19 33030

MATHEMATICS

MATH-201E (Opt. ii)

Mech. Engg. Auto

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Find the Fourier series representing $f(x) = \pi - x$, for $0 < x < 2\pi$. 10

   (b) Find Fourier half-range even expansion of the function, $f(x) = \left(\frac{-x}{l} + 1\right)$, for $0 \le x \le l$. 10

2. (a) Find the Fourier Sine Transform of $g(x) = e^{-x}$. 10

   (b) Using Parseval's identity, prove that :

$$\int_0^\infty \frac{dx}{\left(2^2 + x^2\right)\left(3^2 + x^2\right)} = \frac{\pi}{60}.$$ 10

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Unit II

3. (a) Separate into real and imaginary parts $\tan^{-1}(x + iy)$. 10

   (b) Prove that the function $\cosh z$ is analytic and find its derivative. 10

4. (a) Find the analytic function $w = u + iv$, if $v = \log\left(x^2 + y^2\right) + x - 2y$. 10

   (b) Find the image of $|z - 2i| = 2$ under the mapping of $w = \frac{1}{z}$. 10

Unit III

5. (a) X is a continuous random variable with probability density function given by :

$$f(x) = \begin{cases} kx & (0 \le x < 2) \\ 2k & (2 \le x < 4) \\ -kx + 6k & (4 \le x < 6) \end{cases},$$ find k and mean value of X. 10

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(b) In a bolt factory, machines A, B and C manufacturing 40%, 35% and 25%, of the total. Of their output 2%, 4% and 5% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B or C ? **10**

6. (a) If x is a Poisson variate such that $P(x = 1)$ is equal to $P(x = 2)$. Find the value of the mean of the distribution. **10**

(b) Find the probability of 5 successes in a binomial distribution whose mean and variance are respectively 6 and 2. **10**

Unit IV

7. Using Simplex method :

Max. $Z = 5x + 3y$

Subject to the constraints

$$x + y \leq 2$$
$$5x + 2y \leq 10$$
$$3x + 8y \leq 12$$
$$x, y \geq 0$$

20

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8. Using Dual Simplex method :

Max. $Z = -3x - 2y$

subject to the constraints

$$x + y \geq 1$$
$$x + y \leq 7$$
$$x + 2y \geq 10$$
$$y \leq 3$$
$$x, y \geq 0$$

20

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