

Reg. No. \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017**

**MA202: PROBABILITY DISTRIBUTIONS, TRANSFORMS AND NUMERICAL METHODS**

Max. Marks: 100

Duration: 3 Hours

*Normal distribution table is allowed in the examination hall.*

**PART A (MODULES I AND II)**

*Answer two full questions.*

1. a. Given that  $f(x) = \frac{k}{2^x}$  is a probability distribution of a random variable that can take on the values  $x = 0, 1, 2, 3$  and 4, find k. Find the cumulative distribution function. (7)
- b. If 6 of the 18 new buildings in a city violate the building code, what is the probability that a building inspector who randomly select 4 of the new buildings will catch
- i) none of the new buildings that violate the building code
  - ii) one of the new buildings that violate the building code
  - iii) at least two of the new buildings violate the building code (8)

2. a. Prove that binomial distribution with parameters n and p can be approximated to Poisson distribution when n is large and p is small with  $np = \lambda$  a constant. (7)
- b. Find the value of k for the probability density  $f(x)$  given below and hence find its mean and variance where

$$f(x) = \begin{cases} kx^3 & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

3. a. A random variable has normal distribution with  $\mu = 62.4$ . Find its standard deviation if the probability is 0.2 that it will take on a value greater than 79.2 (7)
- b. The amount of time that a surveillance camera will run without having to be reset is a random variable having the exponential distribution with the parameter 50 days. Find the probability that such a camera will
- i) have to be reset in less than 20 days
  - ii) not have to be reset in at least 60 days. (8)

**PART B (MODULES III AND IV)**

*Answer two full questions.*

4. a. Use Fourier integral to show that  $\int_0^{\infty} \frac{\cos x\omega + \omega \sin x\omega}{1 + \omega^2} d\omega = \begin{cases} 0 & \text{if } x < 0 \\ \pi/2 & \text{if } x = 0 \\ \pi e^{-x} & \text{if } x > 0 \end{cases} \quad (7)$

- b. Represent  $f(x) = \begin{cases} x^2 & 0 < x < 1 \\ 0 & x > 1 \end{cases}$  as a Fourier cosine integral. (8)

5. a. Find the Fourier transform of  $f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{otherwise} \end{cases}$  (7)
- b. Find the Laplace transforms of the following  
 i)  $\cos t - t \sin t$                       ii)  $4t e^{-2t}$  (8)
6. a. Find the inverse Laplace transform of the following  
 i)  $\frac{2s+1}{s^2+2s+5}$                       ii)  $\frac{(2s-10)}{s^3} e^{-5s}$  (8)
- b. Solve  $y'' + 2y' + 5y = 25t$ ,  $y(0) = -2$ ,  $y'(0) = -2$  using Laplace transforms (7)

### PART C (MODULES V AND VI)

*Answer two full questions.*

7. a. Solve  $f(x) = x - 0.5 \cos x = 0$  near  $x = 0$  by fixed point iteration method. (7)
- b. Solve  $f(x) = 2x - \cos x = 0$  by Newton Raphson's method (7)
- c. Find  $f(9.2)$  from the values given below by Lagrange's interpolation formula
- |        |          |          |          |          |
|--------|----------|----------|----------|----------|
| $x$    | 8        | 9        | 9.5      | 11       |
| $f(x)$ | 2.197225 | 2.251292 | 2.397895 | 2.079442 |
- (6)
8. a. Given  $(x_j, f(x_j)) = (0.2, 0.9980), (0.4, 0.9686), (0.6, 0.8443), (0.8, 0.5358), (1, 0)$ , find  $f(0.7)$  based on 0.2, 0.4, and 0.6 using Newton's interpolation formula. (10)
- b. Solve  $10x_1 + x_2 + x_3 = 6$ ,  $x_1 + 10x_2 + x_3 = 6$ ,  $x_1 + x_2 + 10x_3 = 6$  by Gauss-Seidel iteration method starting at  $x_1 = 1$ ,  $x_2 = 1$  and  $x_3 = 1$  correct to 4 digits. (10)
9. a. Evaluate  $\int_0^1 \frac{1}{1+x^2} dx$  with 4 subintervals by Simpson's rule and compare it with the exact solution. (7)
- b. Solve  $y' = y$ ,  $y(0) = 1$  by Euler method to find  $y(1)$  with  $h = 0.2$  (7)
- c. Solve  $y' = 1 + y^2$ ,  $y(0) = 0$  by fourth order Runge-Kutta method with  $h = 0.1$ , 5 steps. (6)

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