B.E. (Electrical Engineering (Electronics & Power)) Fourth Semester (C.B.S.)

# Applied Mathematics - IV

## Paper - I

P. Pages : 3 **TKN/KS/16/7366**

Time : Three Hours * 0 4 7 6 * Max. Marks : 80

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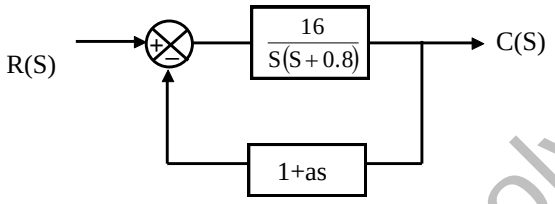
Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Use of non programmable calculator is permitted.

**1.** a) Define : **6**
i) Step signal ii) Ramp signal
iii) Parabolic signal and
Find their laplace transform.

b) For a system shown below, find the value of 'a' such that the damping ratio is 0.5. **6**
Determine the rise time, peak time in the unit step response.




**OR**

**2.** a) Discuss time response of a general second order system in a unit step input. **6**

b) Define transfer function and obtain it for series R-C circuit. **6**

**3.** a) **6**
If $z\{f(n)\} = f(z)$ then prove that $z\{f(n+k)\} = z^k\left[F(z) - \sum_{i=0}^{k-1} f(i)\,z^{-i}\right]$ for k > 0.

b) Find z-Transform of $\frac{(k+1)(k+2)}{2!}a^k$ **6**

**OR**

**4.** a) Find inverse z-transform of $\frac{3z^2+2z+1}{z^2-3z+2}$ **6**

b) Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ given $y_0 = 0 = y_1$. **6**

**5.** a) Define : **6**

i) Fuzzy set

ii) $\alpha$ - level set

iii) Normalized fuzzy set.

b) If $X = \{x_1, x_2, x_3\}$, $Y = \{y_1, y_2, y_3\}$ The fuzzy set A of X, fuzzy set B of Y are defined as follows : **6**

$A = \{0.2/x_1, 0.3/x_2, 0.5/x_3\}$

$B = \{0.5/y_1, 0.6/y_2, 0.7/y_3\}$

Then Find $A \times B$.

**OR**

**6.** a) If fuzzy sets are - **6**

$A = \frac{0.3}{30} + \frac{0.7}{60} + \frac{1}{100}$, $B = \frac{0.2}{20} + \frac{0.4}{40} + \frac{0.6}{60}$, $C = \frac{0.3}{50} + \frac{0.6}{100}$

Find fuzzy relation $R = A \times B$, $S = B \times C$. Also find $R \bigcup S$.

b) Given the membership function for the fuzzy sets A, B and C as **6**

$\mu_A(x) = \frac{x}{x+2}$, $\mu_B(x) = 2^{-x}$ and $\mu_C(x) = \frac{1}{1+10(x-2)^2}$

Where x = {0, 1, 2, 3, 4, 5} Plot the graph $\mu_A, \mu_B$ and $\mu_C$ check whether

i) $A \bigcup (\overline{A} \bigcap B) = A \bigcup B$

ii) $A \bigcap \overline{A} = \phi$

**7.** a) Find the root of the equation $x + \log_{10} x - 3.375 = 0$ correct upto three decimal places. Using Newton Raphson method. **6**

b) Apply Crout's method to solve the equations : **6**

3x + 2y + 7z = 4

2x + 3y + z = 5

3x + 4y + z = 7

**OR**

**8.** a) Find the root of $e^x - 4x = 0$ by Regula falsi method correct upto third decimal place. **6**

b) Solve by Gauss - Seidal method **6**

$2x - 3y + 20z = 25$

$20x + y - 2z = 17$

$3x + 20y - z = -18$

**9.** a) Using Euler's modified method solve $\frac{dy}{dx} = x + y$ for x = 0.1, given that y(0) = 1, h = 0.05. **7**

b) Use Runge Kutta method to find approximate value of y for x = 0.2 when $\frac{dy}{dx} = xy + y^2$ given y(0) = 1, h = 0.1. **7**

**OR**

**10.** a) Use Milne's predictor correction method to find y(0.4) from $\frac{dy}{dx} = 1 + xy^2$ y(0) = 1, y(0.1) = 1.105, y(0.2) = 1.223 , y(0.3) = 1.355 **7**

b) Solve $\frac{dy}{dx} = yz + x$, $\frac{dz}{dx} = xz + y$ for x = 0.2 given y(0) = 1, z(0) = -1, by Runge Kutta method upto 3 decimals. **7**

**11.** a) A random variable X has density function **6**

$f(x) = kx^2 \quad 1 \le x \le 2$

$= kx \quad 2 < x < 3$

$= 0 \quad$ otherwise

Find the constant k and the distribution function.

b) Find the mean, median and mode for a random variable x having probability density function **6**

$f(x) = 4x(1 - x^2) \quad 0 < x < 1$

$= 0 \quad$ otherwise

c) Find moment generating function of a random variable **6**

$X = \frac{1}{2}$ Prob $\frac{1}{2}$

$= -\frac{1}{2}$ Prob $\frac{1}{2}$

Also find first four moments about origin.

**OR**

**12.** a) Find the probability of getting between 2 heads to 4 heads in 10 tosses of fair coin using normal distribution. **6**

b) Find the coefficient of **6**

i) skewness and ii) kartosis of distribution

$f(x) = 4x(9 - x^2)/81 \quad 0 < x \le 3$

$= 0 \quad$ otherwise

c) **6**

Can the function $f(x) = c(1 - x^2) \quad 0 \le x \le 1$

$= 0 \quad$ otherwise

be a distribution function ? Explain.

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