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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular / Supplementary) - May, 2019

**Regulation: IARE – R16**

## MATHEMATICAL TRANSFORM AND TECHNIQUES

**Time: 3 Hours**

**(Common to ME | CE)**

**Max Marks: 70**

**Answer ONE Question from each Unit**

**All Questions Carry Equal Marks**

**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define a periodic function for the function  $f(x)$  and give example. Write the fourier series for even function. [7M]
- (b) Find a Fourier series to represent  $x^2$  in the interval  $(-l, l)$ . [7M]
2. (a) Write the Dirichlet's conditions for the existence of Fourier series of a function  $f(x)$ . What are the conditions for expansion of a function in Fourier series. [7M]
- (b) Expand  $f(x) = \begin{cases} \frac{1}{4} - x, & \text{if } 0 < x < \frac{1}{2} \\ x - \frac{3}{4}, & \text{if } \frac{1}{2} < x < 1 \end{cases}$  in the half range Fourier series of sine terms. [7M]

### UNIT – II

3. (a) State and prove Modulation theorem of Fourier transform. [7M]
- (b) Find the Fourier transform of  $f(x)$  defined by  $f(x) = \begin{cases} a^2 - x^2 & \text{if } |x| < a \\ 0, & \text{if } |x| > a > 0 \end{cases}$  [7M]
4. (a) State Fourier integral theorem. Write the properties of Fourier transform of  $f(x)$ . [7M]
- (b) Find the Fourier sine and cosine transforms of  $f(x) = \frac{e^{-ax}}{x}$ . [7M]

### UNIT – III

5. (a) Define Laplace transform, and write the sufficient conditions for the existence of Laplace transform. Find the Laplace transform of Dirac delta function. [7M]
- (b) Evaluate the Laplace transform of  $L \left[ \int_0^t te^{-t} \sin 4tdt \right]$ . [7M]
6. (a) State and prove change of scale property of Laplace transform. [7M]
- (b) Solve the differential equation using Laplace transforms  $(D^2 + 4D + 5)Y = 5$ , given that  $Y(0) = 0$ ,  $Y'(0) = 0$ . [7M]

**UNIT – IV**

7. (a) Define convolution theorem of Z-Transform. State and prove linear properties of z- transforms. [7M]  
(b) Using Convolution theorem, evaluate inverse Z-transform of  $\left(\frac{z^2}{(z-a)(z-b)}\right)$ . [7M]
8. (a) State and prove shifting property to the right and left. Find  $Z((-2)^n)$ . [7M]  
(b) Determine  $z[(n+1)^2]$  [7M]

**UNIT – V**

9. (a) Define a non-linear partial differential equation. Define order and degree with reference to partial differential equation. [7M]  
(b) Solve by the method of separation of variables  $u_X = 2u_t + u$  , where  $u(X, 0) = 6e^{-3x}$ . [7M]
10. (a) Define singular and particular integral with reference to nonlinear partial differential equation. [7M]  
(b) Form a partial differential equation by eliminating the arbitrary function from  $z = xy + f(x^2 + y^2)$ . [7M]

