



AD-3258

Third Year B. Sc. (Sem. VI) Examination  
March/April – 2015  
Fourier Transform & its Applications  
(Generic Elective - 6004)

Time : 3 Hours]

[Total Marks : 70

Instructions :

(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवही पर अवश्य लपनी.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
Third Year B. Sc. (Sem. VI)

Name of the Subject :  
FOURIER TRANSFORM & ITS APPLICATIONS

Subject Code No. : 3 2 5 8 Section No. (1, 2,.....): Nil

Seat No. :

Student's Signature

- (2) All questions are compulsory.  
(3) Figures to the right indicate full marks of the corresponding question.

1 Answer the following : (any five) 5

- (1) State Parseval's identities for Fourier cosine transform.  
(2) State one dimensional heat-flow equation.  
(3) Write the complex form of Fourier Integral and also write inverse Fourier Transform of  $f(x)$ .  
(4) Define Convolution of two functions.

(5) Prove that  $F\left[\frac{\partial^2 u}{\partial x^2}\right] = -s^2 F[u]$ .

- (6) State the change of scale property for Fourier sine transform.  
(7) Define Fourier transform.  
(8) State one dimensional wave equation for vibrating string.

- 2 (a) State and prove shifting property of Fourier Transform. 8

OR

- (a) Derive Fourier sine and cosine integral. 8

- (b) Attempt any two : 7

- (1) Solve the integral equation

$$\int_0^{\infty} f(\theta) \cos \alpha \theta d\theta = \begin{cases} 1-\alpha; & 0 \leq \alpha \leq 1 \\ 0; & \alpha > 1 \end{cases} . \text{ Hence evaluate}$$

$$\int_0^{\infty} \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$$

- (2) Find the Fourier transform of  $f(x) = \begin{cases} 1; & |x| < 1 \\ 0; & |x| > 1 \end{cases}$ .

Hence evaluate  $\int_0^{\infty} \frac{\sin x}{x} dx$ .

- 3 (a) State and prove convolution theorem for Fourier Transform. 8

OR

- (a) State parseval's identity for Fourier Transform and prove it. 8

- (b) Attempt any two : 7

- (1) Using parseval's identity, prove that

$$\int_0^{\infty} \frac{dt}{(a^2+t^2)(b^2+t^2)} = \frac{\pi}{2ab(a+b)}$$

- (2) Using Parseval's identity, If  $f(x) = \begin{cases} 1; & 0 < x < 1 \\ 0; & x > 1 \end{cases}$  then

evaluate  $\int_0^{\infty} \frac{\sin^2 x}{x^2} dx$ .

- 4 (a) Derive Fourier transform of the derivatives of a function. 8

OR

- (a) Determine the distribution of temperature in the semi infinite medium  $x \geq 0$ , when the end  $x = 0$  is maintained at zero temperature and the initial distribution of temperature is  $f(x)$ . 8

- (b) Attempt any two : 7

- (1) Using the Method of residues, evaluate

$$L^{-1} \left\{ \frac{1}{s^2 (s^2 - a^2)} \right\}.$$

- (2) Using the method of residues, evaluate

$$L^{-1} \left\{ \frac{1}{(s+1)(s-1)^2} \right\}.$$

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