

International Islamic University Chittagong  
Department of Computer Science & Engineering  
B.Sc. in CSE Semester Final Examination, Spring -2019  
Course Code: MATH-2407      Course Title: Mathematics-IV

Total Marks: 50

Time: 2 hours & 30 minutes

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[Answer any two questions from Group-A and any three questions from Group-B:  
Separate answer script must be used for Group-A and Group-B]

**Group-A**

1. a) Sketch the following function for four cycles.  $f(t) = \begin{cases} -t; & -\pi \leq t < 0 \\ t; & 0 \leq t < \pi \end{cases}$  03  
b) Find the Fourier series for the function.  $y = f(t) = \begin{cases} 0; & -4 \leq t < 0 \\ 5; & 0 \leq t < 4 \end{cases}$  07

2. a) Derive the Complex form of Fourier series 07  
b) Plot the line spectrum for the following Fourier series: 03

$$f(t) = \frac{\pi}{2} + \sum_{n=1}^{\infty} \frac{1}{2n-1} \cos n\omega t + \sum_{n=1}^{\infty} \frac{(-1)^n}{2n} \sin n\omega t$$

3. Find Convolution Sum  $x[n] * h[n]$  for the following functions 10

$$\begin{array}{ll} x[n] = 1 & ; n = 0 \\ & = 2 & ; n = 1 \end{array} \quad \text{and} \quad \begin{array}{ll} h[n] = 2 & ; n = 0 \\ & = 1 & ; n = 1 \end{array}$$

Where  $n$  is the time index

Group-B

4. a) If  $\mathcal{L}\{F(t)\} = f(s)$  then prove that,  $\mathcal{L}\{F''(t)\} = S^2 f(s) - SF'(0) - F'(0)$  05  
 b) Solve the following IVP by Laplace transform: 05  

$$Y'' + Y = t; Y(0) = 1, Y'(0) = -2$$

5. a) Express the following function in terms of unit step functions and hence find its Laplace transform:  $f(t) = \begin{cases} 8; & t < 2 \\ 6; & t > 2 \end{cases}$  03  
 b) Sketch the wave form of the following signal: 04  

$$x(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$$
  
 c) Evaluate  $\mathcal{L}\{t e^{-3t}\}$  using First shift theorem. 03

6. a) Find the Laplace transform of the functions: 05  
 (i)  $f(t) = 1$   
 (ii)  $f(t) = e^{at}$   
 b) Find the Fourier transform of  $f(t) = \begin{cases} 1, & 0 \leq t < 1 \\ -1, & -1 \leq t < 0 \\ 0, & |t| > 1 \end{cases}$  05

7. a) Write a MATLAB function to construct a complex wave  $f(t)$  in the time interval of  $[-4, 20]$  for the following Fourier series: 05

$$\underbrace{f(t)}_{\text{Complex wave}} = \underbrace{2.5}_{\text{DC value}} + \underbrace{\left[-\frac{5}{\pi} \sum_{n=1}^{\infty} \frac{1}{n} (\cos n\pi - 1) \sin \frac{n\pi t}{4}\right]}_{\text{AC value}}$$

- b) Write MATLAB code to sketch line spectrum (at least 6) for the following Fourier series 03

$$\underbrace{f(t)}_{\text{Complex wave}} = \underbrace{2.5}_{\text{DC value}} + \underbrace{\left[-\frac{5}{\pi} \sum_{n=1}^{\infty} \frac{1}{n} (\cos n\pi - 1) \sin \frac{n\pi t}{4}\right]}_{\text{AC value}}$$

- c) If 02  
 $x[n] = 2 ; n = 0$   
 $\quad = -1 ; n = 1$   
 and  $h[n] = 3 ; n = 0$   
 $\quad = -1 ; n = 1$

Write MATLAB code to find the convolution sum for the above signals.