

**International Islamic University Chittagong**  
**Department of Electrical and Electronic Engineering**

Final Examination Autumn-2018

Course Code: MATH 2404

Time: 2 hours 30 minutes

Program: B.Sc. Engg. (EEE)

### **Course Title: Mathematics-IV**

Full Marks: 50

## Part A

[Answer any two questions from the followings; figures in the right margin indicate full marks.]

- 1(a).** Determine the poles and the residue at each pole of the function  $f(z) = \frac{z^2}{(z-1)^2(z+2)(z-3)}$  03

**1(b).** If  $f(z)$  has a simple pole at  $z = a$ , then prove the  
 $\text{Res } f(a) = \lim_{z \rightarrow a} (z - a)f(z)$  03

**1(c).** Use the residue calculus to evaluate the following integral  $\int_0^{2\pi} \frac{1}{5-4\sin\theta} d\theta$  04

**2(a).** Define Laplace transform. State and prove the Laplace transform of third derivatives. 04

**2(b).** Using the Laplace transforms, find the solution of the initial value problem :  

$$Y'' - 3Y' + 2Y = 4e^{2t}, \quad Y(0) = -3, Y'(0) = 5$$
 03

**2(c).** Evaluate  $L^{-1}\left\{\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right\}$  03

**3(a).** Evaluate  $\int_0^\pi \frac{1}{5-4\sin\theta} d\theta$  by using complex plane. 04

**3(b)** By using L, Determine the current ( $i(t)$ ) in a  $LC$  circuit , assuming  $L = 1$  Henrrey,  $C = 1$  Farad, zero initial current and charge on the capacitor and the voltage  $v(t) = 3V$  06

[Answer : \_\_\_\_\_ margin indicate full marks.]

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|-------|--|----|
| 4(a). | Define unit Impulse function.  | 01 |
| 4(b). | Prove the convolution theorem  | 05 |
| 4(c). | Define periodic function and if $f(t)$ is a periodic function of period $0 \leq t \leq 3$ then determine its Laplace transform.  | 04 |
| 5(a). | What is Fourier Series? Explain the Physical significance of Fourier Series.   | 03 |
| 5(b). | Given that $f(x) = x + x^2$ for $-\pi < x < \pi$ , find the Fourier expression of $f(x)$ . Deduce that,  | 04 |
|       | $\frac{\pi^2}{4} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \dots$  |    |
| 5(c). | $Y = f(t) = \begin{cases} 15 & \text{when } 0 \leq t \leq 4 \\ 0 & \text{otherwise} \end{cases}$<br>(a) Find the Fourier series for the function<br>(b) Sketch the function for 3 cycles     | 03 |
| 6(a). | Define Fourier complex transform when the kernel   | 01 |
|       | $K(s, x) = e^{(-isx)}$   |    |
| 6(b). | Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & \text{when }  x  \leq 1 \\ 0 & \text{when }  x  > 1 \end{cases}$   | 05 |
| 6(c). | Express, the function $f(x) = \begin{cases} 1 & \text{when }  x  \leq 1 \\ 0 & \text{when }  x  > 1 \end{cases}$ , Hence evaluate $\int_{-\infty}^{\infty} \sin \lambda x \cos \lambda x dx$ | 04 |
| 7(a). | If $f(t) = e^{-t}$ and $g(t) = \sin(t)$ , then find its convolution $(f * g)$  | 03 |
| 7(b). | Obtain the Fourier expression for the function $f(x) = x^3$ , for $-\pi < x < \pi$   | 05 |
| 7(c). | If $g(k) = \{15, 10, 7, 4, 2, 0, 3\}$ , and its zero position of the sequence is 0 then find its Z transformation $Z\{g(z)\}$  | 02 |