International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Spring-2019 | Program: B.Sc. Engg. (EEE)
Course Code: Math-1107/1101 | Course Title: Mathematics-I
Time: 2 hours 30 minutes | Full Marks: 50

Part A

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

1(a). If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$, then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$. **3**

1(b). If z is a homogeneous function of x, y, z of degree n, then prove that **3**

$$x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = nz$$

1(c) Show that the function $f(x,y) = x^3 + y^3 - 63(x+y) + 12xy$ **4**
Is maximum at $(-7,-7)$ and minimum at $(3,3)$

2(a). What do you mean by integration? **2**

2(b). Evaluate any two: **4×2**

(i) $\int\left(\sqrt{tanx} + \sqrt{cotx}\right)dx$

(ii) $\int \frac{(x^2+2)}{(x+2)^3(x-1)}dx$

(iii) $\int \frac{x(tan^{-1}x)^2}{(1+x^2)^{\frac{1}{2}}(1+x)}dx$

3(a). Examine $f(x,y) = x^3 + y^3 - 3xy$ for maximum and minimum value. **5**

3(b). Evaluate $\int \frac{dx}{\sin x + \tan x}$ **5**

Part B

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

4(a). If $I_n = \int_0^{\frac{\pi}{4}} \tan^n x \; dx$ then prove that $I_n + I_{n-2} = \frac{1}{n-1}$ **2**

4(b). Evaluate $\int_a^b x\,dx$ as the limit of a sum. **4**

4(c). Define Gamma and Beta function Show that (i)ß(m,n)= $\frac{\Gamma m \Gamma n}{\Gamma(m+n)}$ and (ii)show that **4**
$\Gamma(n+1) = n\Gamma n$

5(a). Evaluate $\iiint_R (x+y+2z)dxdydz$, where R: $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$ **3**

5(b). Evaluate $\iiint_R (x-2y+z)dxdydz$, where R: $0 \le x \le 1, 0 \le y \le x^2, 0 \le z \le x+y$ **5**

5(c) Evaluate $\int_0^1 \int_0^1 e^y dydx$ **2**

6(a). Find the volume of the solid generated by the revolving the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about y axis. **6**

6(b). Find the area between the parabola $y^2 = 4ax$ and $x^2 = 4ay$ **4**

7(a). Prove that $\Gamma(n+1) = n\Gamma(n)$ **2**

7(b). Evaluate $\iint_A xydxdy$ Where A is the domain bounded by x axis ordinate $x = 2a$ and the curve $x^2 = 4ay$ **3**

7(c). Find the volume of the solid generated by revolving the cycloid $x = a(\theta - sin\theta)$ and $y = a(1 - cos\theta)$ about x axis. **5**