Bismillahir Rahmanir Rahim

International Islamic University Chittagong

Department of Computer Science & Engineering

B. Sc. In CSE Semester Final Examination, Autumn 2023

Course Code: MATH-1107 Course Title: Mathematics-I

Total Marks: ***50*** Time: 2 Hours 30 Minutes

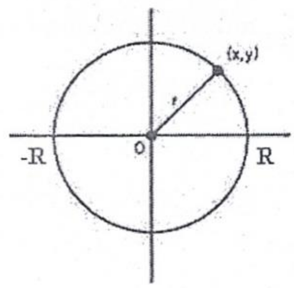
[Answer ***all*** the questions. Figures in the right hand margin indicate full marks. Separate answer script must be used for Group A and Group B]

Group – A

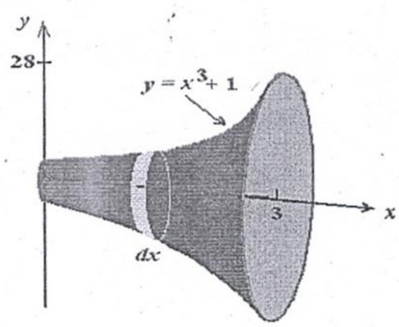
			Marks	CLO	DL
1.	a)	Define partial derivatives. If $u = \sqrt{x^2 + y^2 + z^2}$ then prove that $u_{xx} + u_{yy} + u_{zz} = \frac{2}{u}$	5	CLO1	R&U
	Or)	Define Homogeneous function. If $u = \sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ then using the Euler's theorem on homogeneous function show that, $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{\tan u}{2}$			
	b)	Find the local maxima and local minima of the function: $f(x) = 2x^3 - 3x^2 + 6$ with graphical presentation.	5	CLO1	U
2.	a)	Evaluate the Integral, $\int \frac{2x+3}{3x^2-x+1}\,dx$	5	CLO2	U
	Or)	Evaluate the Integral, $\int \frac{dx}{(2x+3)\sqrt{x^2+3x+2}}$			
	b)	(i) Evaluate the Integral, $\int x \log x dx$	3	CLO2	U
		(ii) Evaluate the Integral, $\int e^x\{\frac{1}{2}\operatorname{cosec}^2\frac{x}{2} - \cot\frac{x}{2}\}\,dx$	2	CLO2	U

Group – B

			Marks	CLO	Level
3.	a)	Evaluate the Integral, $\int_0^1 x^2\,dx$ by geometrically.	5	CLO2	U
	b)	If $I_n = \int_0^{\pi/4} tan^n\theta\, d\theta \;\; and \;\; n > 1$ then using the reduction formula prove that, $n(I_{n-1} + I_{n+1}) = 1$	5	CLO2	U
	Or)	**Show that** $\int_0^{\pi} \frac{x}{1+\sin x}dx = \pi$			
4.	a)	Evaluate the triple integral, $\int_0^1 \int_0^{1-x} \int_0^{1-y^2} z\; dz\, dy\, dx$	5	CLO2	U
	b)	Define Gamma and Beta function. Using the definition prove that, $\beta(m,n) = 2\int_0^{\pi/2} sin^{2m-1}\theta\; cos^{2n-1}\theta\; d\theta$	5	CLO2	U
	Or)	**Show that** $\int_0^{\pi/2} \cos^8 x \sin^6 x dx = \frac{5\pi}{4096}$			
5.	a)	Find the length of circumference of a circle $\mathbf{x^2 + y^2 = R^2}$ of radius ***R***.	6	CLO3	Ap



	b)	Find the volume of the solid of revolution generated by the graph $\mathbf{y = x^3 + 1}$ between $x = 0$ to $x = 3$ about the x-axis.	4	CLO3	Ap



International Islamic University Chittagong (IIUC)
Department of Computer Science and Engineering (CSE)
B. Sc. in CSE, Semester Final Examination, Spring-2019
Course Code: MATH-1107, Course Title: Mathematics-I
Time: 2 hours 30 minutes Marks: 50

(Answer any two (02) questions from Group-A. and any three (03) questions from Group-B. Separate answer script must be used for separate group. Figures in the right margin indicates full marks)

$Group - A$

1. a) Define Partial Derivatives. If $u = e^x(x\cos y - y\sin y)$ then show that, **1+4=5**

$$\frac{\delta^2 u}{\delta x^2} + \frac{\delta^2 u}{\delta y^2} = 0$$

b) Define Homogeneous function and state Euler's theorem. If $u = \sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$ then using Euler's theorem on homogeneous function, Show that, **5**

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{\tan u}{2}$$

2. a) Explain maximum and minimum values of a function. Discuss the maximum and minimum value for $y = x^2 + \frac{250}{x}$ **5**

b) If $u = \ln(x^3 + y^3 + z^3 - 3xyz)$ then show that, **5**

$$\left(\frac{\delta}{\delta x} + \frac{\delta}{\delta y} + \frac{\delta}{\delta z}\right)^2 u = \frac{-9}{(x+y+z)^2}$$

3. a) Evaluate the Integral, (i) $\int \frac{3x}{x^2-x-2} dx$ (ii) $\int \frac{x^2}{x^2-2} dx$ **10**

(iii) $\int e^x \frac{1+\sin x}{1+\cos x} dx$ (iv) $\int \frac{dx}{(x-3)\sqrt{x-2}}$

Group-B

4. a) Evaluate the Integral, $\int_0^1 x^2 \, dx$ as the limit of a sum. 5

b) If n is a positive integer then evaluate $\int \sin^n x \, dx$ as Reduction formula 5

5. a) Write any five general properties of definite integral. Using the properties of definite integral find the value of $\int_0^{\pi} \frac{x}{1+\sin x} \, dx$ 5

b) Evaluate the triple integral, $\int_0^{3y} \int_1^{yz} \int_2^{3} (2x + y + z) \, dy \, dx \, dz$ 5

6. a) Define Gamma and Beta function. Prove that, $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ 3

b) Evaluate the Integral, $\int_0^2 x(8 - x^3)^{\frac{1}{3}} \, dx$ using Gamma and Beta function. 4

c) Using Gamma and Beta function prove that, $\int_0^1 \frac{dx}{(1-x^n)^{\frac{1}{n}}} = \Gamma\left(1 + \frac{1}{n}\right) \Gamma\left(1 - \frac{1}{n}\right)$ 3

7. a) Find the length of the arc AB of the curve with equation $y = \frac{2}{3} x^{\frac{3}{2}}$ where the X-coordinates of A and B are 3 and 8 respectively. 5

b) What area is swept out when the curve of $y = \sin x$ in the range $0 \le x \le \pi$ is rotated completely about the x-axis? 5

International Islamic University Chittagong
Department of Computer Science & Engineering
B.Sc. in CSE, Final Examination, Autumn-2018
Course Code: MATH-1107 **Course Title: Mathematics-I**

***Total Marks:* 50** ***Time:* 2 hours & 30 minutes**

[*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) What is meant by homogeneous function? State and Prove Euler's theorem on homogeneous functions of degree n in x and y. 5

(b) If $u = \tan^{-1}\dfrac{x^3 + y^3}{x^2 + y^2}$ then show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \dfrac{1}{2}\sin 2u$ 5

2(a) Define Maxima and Minima of a function. If $x + y = 2$ then find the maxima and minima of the function, $u = \frac{4}{x} + \frac{36}{y}$ 1+4

(b) Find the extreme values of $f(x,y) = x^3 + y^3 - 3axy$ 5

3 Evaluate any four integrals: (i) $(i)\ \int \frac{1}{(x+3)\sqrt{x^2+4x+6}}\,dx$ (ii) $\int \frac{dx}{(x+2)\sqrt{1+x}}$ 10

(iii) $\int \dfrac{6x-8}{\sqrt{3x^2-8x+5}}\,dx$ (iv) $\int \frac{dx}{16x^2-9}$ (v) $\int \dfrac{dx}{4x^2+8x+13}$

Group-B

4(a) Find by the method of summation the value of $\int_{-1}^{2} x^2 dx$ 5

(b) If $I_n = \int_0^a (a^2 - x^2)^n\, dx$, n >0 then show that $I_n = \dfrac{2na^2}{2n+1} I_{n-1}$ 5

5(a) Show that, $\int_0^{\pi/2} \frac{dx}{1+\cos^2 x} = \frac{\pi}{2\sqrt{2}}$ 5

(b) Evaluate the triple integral, $\int_0^1 \int_0^{1-x} \int_0^{1-y^2} z\ dz\, dy\, dx$ 5

6(a) Define Beta function. Prove that $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} Sin^{2m-1}\theta \cos^{2n-1}\theta \, d\theta$ 5

(b) Prove that $\int_0^1 x^2(1-x^2)^{5/2}\,dx = \frac{5\pi}{256}$ 5

7(a) Find the length of the arc AB of the curve with equation $y = \frac{2}{3}x^{\frac{3}{2}}$ where the X-coordinates of A and B are 3 and 8 respectively. 5

(b) Find the volume of the solid generated by the revolution of an ellipse round its minor axis. 5

International Islamic University Chittagong
Department of Computer Science & Engineering
B.Sc. in CSE Semester Final Examination, Spring-2018
Course Code: MATH-1107 Course Title: Mathematics-I

Total Marks: 50 *Time: 2 hours & 30 minutes*

[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) Define Partial Derivatives. If $u = a\log(x^2+y^2) + b\tan^{-1}\left(\frac{y}{x}\right)$ then show that, $\frac{\delta^2 u}{\delta x^2} + \frac{\delta^2 u}{\delta y^2} = 0$. 1+4
   b) Find the extreme values of $f(x,y) = x^3 + y^3 - 3x - 12y + 20$ 05

2. Evaluate the following indefinite integrals: 10
   i. $\int \frac{dx}{x^2+6x+25}$ ii. $\int \frac{\sin(2+5\ln x)}{x} dx$ iii. $\int \frac{dx}{16-25x^2}$ iv. $\int \frac{dx}{(x-3)\sqrt{1+x}}$

3. a) What is homogeneous function? State and prove Euler's theorem for homogeneous function of degree n. 05
   b) Evaluate the Integrals, $(i)\ \int x\cos^{-1}x\, dx$ $(ii)\ \int e^x\left(\frac{1-x}{1+x^2}\right)^2 dx$ 3+2

Group-B

4. a) Evaluate the Integral, $\int_0^1 e^x\, dx$ by geometrically. 05
   b) If n is a positive integer then evaluate $\int cos^n x\ dx$ as Reduction formula 05

5. a) Evaluate: (i) $\int_1^2 x\ln x\, dx$, correct to the 3 significant figures. 03
   (ii) $\int_1^4 \left(\frac{\theta+2}{\sqrt{\theta}}\right) d\theta$, taking positive square roots only. 03
   b) Evaluate the integral $\int_{-3}^{3}\int_{0}^{1}\int_{1}^{2}(x+y+z)\,dx\,dy\,dz$ 04

6 a) Define Gamma and Beta function. Prove that, $\Gamma(n+1) = n\Gamma(n)$ 04
   b) Prove that, $\int_0^1 \frac{x^5}{\sqrt{1-x^2}} dx = \frac{8}{15}$ Using Gamma and Beta function. 03
   c) Show that $\beta(m,n) = 2\int_0^{\frac{\pi}{2}} \sin^{2m-1}\theta \cos^{2n-1}\theta\, d\theta$ 03

7. a) Find the circumference of the circle, $x^2 + y^2 = 16$ 05
   b) Find the area bounded by the parabola $x^2 = 12y$ and $y^2 = 12x$ 05

International Islamic University Chittagong (IIUC)
Department of Computer Science and Engineering (CSE)
Semester Final Examination

Program: B. Sc. in CSE | **Semester: Autumn-2022**
Course Code: MATH-1107 | **Course Title: Mathematics-I**
Time: 2:30 hours | **Total Marks: 50**

(i)	Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii)	Please answer the several parts of a question sequentially.
(iii)	Separate answer script must be used for separate group.
(iv)	Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

CLO1:	Compute the functions, derivatives, integrals and extrema of single-variable and/or multivariable functions.
CLO2:	Understand the techniques of differentiation and integration.
CLO3:	Demonstrate the applications of differentiation and integration.

Bloom's Taxonomy Domain Levels of the Questions

Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Group – A

			Marks	CLO	DL
1.	a)	If $u = a\log(x^2+y^2)+b\tan^{-1}\left(\frac{y}{x}\right)$ then show that, $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0.$	5	CLO1	R&U
	Or)	If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ then using Euler's theorem show that, $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{\tan u}{2}.$	5	CLO1	R&U
	b)	Define maxima and minima of a function. Findthe maxima and minima of the function, $f(x)=2x^3-21x^2+36x-20$.	5	CLO1	U
2.	a)	Evaluate the following integral i). $\int\frac{dx}{4x^2+8x+13}$ ii) $\int\frac{x^2}{x^2-4}dx$	5	CLO2	U
	Or)	Evaluate the following integral i). $\int\frac{dx}{(2x+1)\sqrt{4x+3}}$ ii) $\int\frac{dx}{(2+x)\sqrt{1+x}}$	5	CLO2	U
	b)	(i) Evaluate the Integral $\int x^2e^x dx$	3	CLO2	U
		(ii) Evaluate the Integral $\int e^x(\sin x-\cos x)dx$.	2	CLO2	U

Group – B

			Marks	CLO	DL
3.	a)	Evaluate the integral $\int_0^1 x^2 dx$ by geometrically	5	CLO2	U
	b)	Prove that, $\int \sin^n x dx = -\frac{1}{n}\sin^{n-1} x \cos x + \frac{n-1}{n}\int \sin^{n-2} x dx$	5	CLO2	U
	Or)	Prove that, $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}} dx = \frac{\pi}{4}$.	5	CLO2	U
4.	a)	Evaluate the triple $\int_0^1 \int_0^x \int_0^y x^3 y^2 z \, dz \, dy \, dx$.	5	CLO2	U
	b)	Prove that i) $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ ii). $\Gamma(n+1) = n\Gamma(n)$.	5	CLO2	U
	Or)	Define Gamma and Beta function. Show that, $\int_0^{\pi/2} \cos^8 x \sin^6 x dx = \frac{5\pi}{4096}$	5	CLO2	U
5.	a)	Find the arc length along the curve $y = \frac{2}{3}x^{3/2}$ between $x = 3 \text{ and } x = 8$.	4	CLO3	Ap
	b)	Find the area of the surface generated by revolving the arc of the curve of $y = x^3$ from $x = -1$ *to* $x = 2$ about the x-axis.	3	CLO3	Ap
	c)	Find the volume of the solid of revolution generated by the graph $y = x^2$ between $x = 0$ *to* $x = 2$ about the x-axis.	3	CLO3	Ap