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

Semester: Autumn-2022
Program: B. Sc. in CSE
Course Title: Mathematics-III
Course Code: MATH-2307
Total Marks: 50
Time: 2:30 hours

(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:	Understand the fundamentals of Matrix, Linear system of equations & Vector analysis.
CLO2:	Implement the fundamental knowledge of Matrix, linear system of equations, vector functions, vector field, scalar field, gradient, divergence, curl, differentiation and integration of vector valued functions, partial derivatives in different problems.
CLO3:	Solve line integrals, surface area, surface integrals, volume integrals, and the work done in different problems.
CLO4:	Apply Green's theorem, Stoke's theorem, and Gauss' theorem in solving mathematical problems.

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.		Given the following system of linear equations, determine the value of each of the variables using the LU decomposition method. $6x_1 - 2x_2 = 14$ $9x_1 - x_2 + x_3 = 21$ $3x_1 - 7x_2 + 5x_3 = 9$	10	CLO2	App
2.	a)	What do you mean by unit vector? Find a unit vector parallel to the resultant of vectors, $\vec{A} = 2\hat{\imath} + 4\hat{\jmath} - 5\hat{k}$ and $\vec{B} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$	5	CLO2	R&U
	Or)	Define vector product and scalar product. Find the angles which the vector, $\vec{A} = 2\hat{\imath} - \hat{\jmath} + 2\hat{k}$ makes with the coordinates axes.			
	b)	If $\emptyset(x,y,z) = xy^2z$ and $\vec{A} = xz\hat{\imath} - xy^2\hat{\jmath} + yz^2\hat{k}$, then find $\frac{\partial^3}{\partial x^2 \partial z}(\emptyset\vec{A})$ at the point $(2, -1, 1)$	5	CLO2	U
	Or)	A particle moves along a curve whose parametric equations are, $x = 2t^2,\ y = t^2 - 4t\ \&\ z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction $\vec{A} = \hat{\imath} - 3\hat{\jmath} + 2\hat{k}$			

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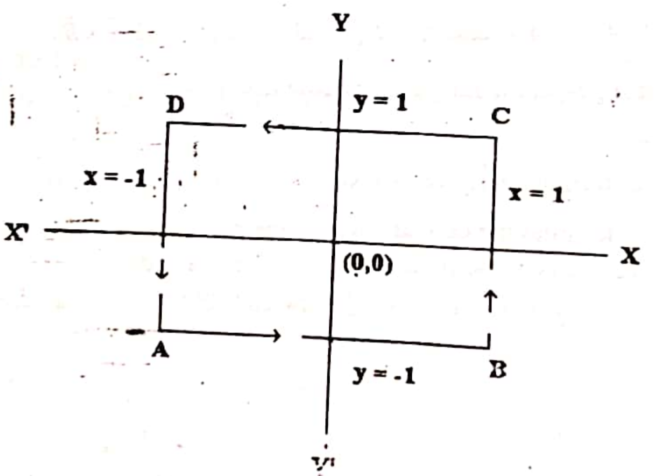
Group – B

			Marks	CLO	DL
3.	a)	Define Gradient, Divergence and Curl. Prove that, $\nabla^2\left(\frac{1}{r}\right) = 0$	5	CLO2	R&U
	Or)	Find the values of constants $a,\ b\ and\ c$ so that, $\vec{F} = (x+2y+az)\hat{\imath} + (bx-3y-z)\hat{\jmath} + (4x+cy+2z)\hat{k}$ is irrotational.			
	b)	If $\vec{F} = xy\hat{\imath} - z\hat{\jmath} + x^2\hat{k}$ and C is the curve $x=t^2, y=2t, z=t^3$ from $t=0$ to $t=1$, then evaluate the line integral, $\int_c \vec{F} \times \overrightarrow{dr}$	5	CLO3	U
	Or)	Find the work done in moving a particle once around a circle C in xy plane, where the circle has center at the origin and radius 3 and the force field is given by $\vec{F} = (2x - y + z)\hat{\imath} + (x + y - z^2)\hat{\jmath} + (3x - 2y + 4z)\hat{k}$			
4.		Verify the Divergence theorem for $\vec{F} = (2xy + z)\hat{i} + y^2\hat{j} - (x + 3y)\hat{k}$ taken over the region bounded by the planes, $2x + 2y + z = 6, x = 0, y = 0, z = 0$	10	CLO4	App
5.		Use Green's theorem to evaluate $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square formed by the lines $y = \pm 1, x = \pm 1$	10	CLO4	App



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International Islamic University Chittagong

Department of Computer Science & Engineering

B.Sc. in CSE Final Examination, Spring 2022

Course Title: Mathematics-III Course Code: MATH-2307 (New)

Course Title: Mathematics-IV Course Code: MATH-2401 (Old)

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

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs) of the Questions	
CO1	**Understand** the fundamentals of Matrix, Linear system of equations & Vector analysis
CO2	**Implement** the fundamental knowledge of Matrix, linear system of equations, vector functions, vector field, scalar field, gradient, divergence, curl, differentiation and integration of vector valued functions, partial derivatives in different problems
CO3	**Solve** line integrals, surface area, surface integrals, volume integrals, and the work done in different problems
CO4	**Apply** Green's theorem, Stoke's theorem, Gauss' theorem in solving mathematical problems

Bloom's Levels of the Questions						
Letter Symbols	**R**	**U**	**App**	**An**	**E**	**C**
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

Answer the following questions

1. a)	Examine the eigen decomposition for the matrix $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$	CO1	An	10
	Or			
1. a)	(a) If $\bar{A} = A_x\bar{i} + A_y\bar{j} + A_z\bar{k}$ and $\bar{B} = B_x\bar{i} + B_y\bar{j} + B_z\bar{k}$ find $\bar{A}\times\bar{B}$.	CO1	An	5
1. b)	Find a unit vector perpendicular to the vector $\bar{a} = 3\bar{i} + \bar{j}$ and $\bar{b} = -\bar{i} + 2\bar{j} + 2\bar{k}$.	CO1	An	5
2. a)	A particle moves through 3-space in such a way that its velocity is $\vec{v}(t) = \hat{i} + t\hat{j} + t^2\hat{k}$. Find the co-ordinates of the particle at time $t = 1$ given that the particle is at the point $(-1,2,4)$ at time $t = 0$	CO2	App	5
2. b)	Show that $\bar{A} = \bar{i} + 2\bar{j} - 3\bar{k}$, $\bar{B} = 2\bar{i} - \bar{j} + 2\bar{k}$ and $\bar{C} = 3\bar{i} + \bar{j} - \bar{k}$ are coplanar.	CO2	App	5

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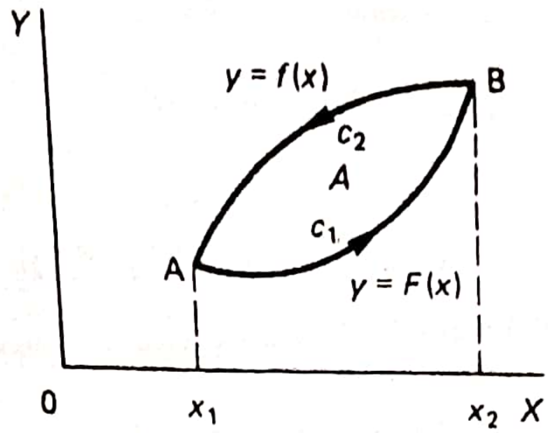
Part B

Answer the following questions

3.	a) Find the directional derivative of the function $\phi = x^2y + y^2z + z^2x$ at the point of (1, -1, 2) in the direction of the vector $\vec{A} = 4\hat{i} + 2\hat{j} - 5\hat{k}$.	CO2	U	4
	b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 2$ and $z = x^2 + y^2 - 1$ at the point (2,-1, 2)	CO2	U	4
	c)  What is the value of A?	CO3	U	2
4.	a) Evaluate the line intregal $\int \bar{F}.d\bar{r}$ where the force field is given by $\bar{F}(x,y) = 3xy\bar{i} - 5z\bar{j} + 10x\bar{k}$ along the curve $x = t^2 + 1, y = 2t^2, z = t^3$ from t=1 to t=2.	CO3	App	5
	b) Evaluate $\int_c xy\,dx$ from B(1,0) to C(0,1) along the curve C that is the portion of $x^2 + y^2 = 1$ in the first quadrant.	CO3	App	5
5.	a) Verify the Divergence theorem for $\vec{F} = (2xy + z)\hat{i} + y^2\hat{j} - (x + 3y)\hat{k}$ taken over the region bounded by the planes, $2x + 2y + z = 6, x = 0, y = 0, z = 0$	CO4	App	10
	Or			
5.	a) Find the work done by the force $F(x,y) = x^3y\bar{i} + (x - y)\bar{j}$ on a particle that moves along the parabola $y = x^2$ from (-2,4) to (1,1).	CO4	App	5
	b) Evaluate $\int_c xy\,dx + (2x - y)dy$ round the region bounded on the curve $y = x^2$ and $x = y^2$ by using Green's theorm.	CO4	App	5

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International Islamic University Chittagong

Department of Computer Science & Engineering

B.Sc. in CSE Semester Final Examination, Spring-2019

Course Code: MATH-2307 Course Title: Mathematics-III

Time: 2 hours & 30 minutes

Total Marks: 50

[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) Find a unit vector perpendicular to the vectors $\vec{a} = 3\hat{i} + \hat{j}$ and $\vec{b} = -\hat{i} + 2\hat{j} + 2\hat{k}$ 5

b) Find the angles between the vectors $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ with the coordinate's axes. 5

2. a) If $\phi(x, y, z) = xy^2z$ and $\vec{A} = xz\hat{i} - xy^2\hat{j} + yz^2\hat{k}$, then find $\frac{\partial^3}{\partial x^2 \partial z}(\phi\vec{A})$ at the point $(2, -1, 1)$ 5

b) A particle moves so that its position vector is given by $\vec{r} = \cos\omega t\, \hat{i} + \sin\omega t\, \hat{j}$ where ω is a constant. Show that, 5

(i) The velocity v of the particle is perpendicular to r,

(ii) The acceleration a is directed toward the origin and has magnitude proportional to the distance from the origin.

(iii) $r \times v$ = a constant vector.

3. Solve the linear system of equations using LU decomposition 10

$$u_1 + 2u_2 + 3u_3 = 5$$

$$2u_1 - 4u_2 + 6u_3 = 18$$

$$3u_1 - 9u_2 - 3u_3 = 6$$

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Group-B

4. a) Gives physical examples of gradient, divergence and curl.

b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2,-1, 2) 3

c) Find a unit normal to the surface $x^2y + 2xz = 4$ at the point $(2,-2,3)$ 4

3

5. a) Evaluate the line integral $\int_C xy\,dx$ along the curve C that the portion of $x^2 + y^2 = 1$ in the first quadrant. 5

b) Find work done in moving a particle in a force field given by $\vec{F} = 3xy\hat{\imath} - 5z\hat{\jmath} + 10x\hat{k}$ along the curve $x = t^2 + 1,\ y = 2t^2 \,\&\, z = t^3$ from $t = 1\ to\ t = 2$ 5

6. Find the area of a circle $x^2 + y^2 = 4$ using $A = -\oint y\,dx = -\{\int_{x_1}^{x_2} F(x)dx + \int_{x_2}^{x_1} f(x)dx\}$ 10

7. Verify the divergence theorem for the vector field $\vec{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$ taken over the region bounded by the planes. $x = 0,\ x = 1;\ y = 0,\ y = 1;\ z = 0,\ z = 1$ 10

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International Islamic University Chittagong

Department of Computer Science & Engineering

B.Sc. in CSE Semester Final Examination, Autumn-2018

Course Code: MATH-2401 **Course Title: Mathematics-IV**

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

. Define LU decomposition. Solve the Linear system using LU decomposition. **10**

$$2x - y + 3z = 9, x + y + z = 6, \quad x - y + z = 2.$$

a) If Given, $\vec{v}(t) = \hat{i} + t\hat{j} + t^2\hat{k}$, Find $\vec{r}(t) = ?$ **2**

b) **Which one is correct** **1**

i. $\delta\vec{r} > d\vec{r}$

ii. $\delta\vec{r} < d\vec{r}$

c) Draw the graph of the vector $3\hat{i} \times 4\hat{j}$ **1**

d) Draw a graph of $d\vec{r}$ vector **1**

e) A particle moves along a curve whose parametric equations are $x = 2t^2, y = \cos t, z = 3\sin 3t$, where t is time. **4**

(i) Determine the velocity and acceleration at any time.

(ii) Find the magnitudes of the velocity at t=0

f) Is the vector $\dfrac{2\hat{i} - 6\hat{j} + 7\hat{k}}{\sqrt{89}}$ a unit vector? **1**

a) Show that $\vec{\nabla}\phi$ is a vector perpendicular to the surface $\phi(x, y, z) = c$, where c is a constant. **3**

b) Find a unit normal to the surface $x^2y + 2xyz = 5$ at the point (2,2,3) **3**

c) Find the angle between the surfaces $x^2 + y^2 + z^2 = 10$ and $z = x^2 + y^2 - 2$ at the point (2,-1, 2) **4**

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Group-B

4. a). Sketch the level curve for the function $f(x,y) = x^2 + y^2$ through the point (3, 4) and draw the gradient vector at this point. 3

b) **Show that $\vec{\nabla} \cdot \vec{r} = 3$** 2

c) Show that $\vec{\nabla}.(r^3\vec{r}) = 6r^3$ 3

d) Show that, $\vec{\nabla} = \frac{\vec{r}}{r}\frac{\partial}{\partial r}$ 2

5. a) Find the work done in moving a particle once around a circle C in the xy plane, If the circle has center at the origin and radius 3 and the force field is given by $\vec{F} = (2x - y + z)\hat{\imath} + (x + y - z^2)\hat{\jmath} + (3x - 2y + 4z)\hat{k}$ 5

b) Evaluate the line integral, $\int_c \vec{F}.d\vec{r}$ where the force field is given by $\vec{F}(x,y) = 3xy\,\hat{\imath} - 5z\hat{\jmath} + 10x\hat{k}$ along the curve, $x = t^2 + 1, y = 2t^2$ *and* $z = t^3$ from $t = 1$ *to* $t = 2$

6. Verify the Divergence theorem for $\vec{F} = (2xy + z)\hat{\imath} + y^2\hat{\jmath} - (x + 3y)\hat{k}$ taken over the region bounded by the planes, $2x + 2y + z = 6,\ x = 0,\ y = 0,\ z = 0$

7. Evaluate $I = \oint_C \{(2x + y)dx + (3x - 2y)dy\}$ taken in an anticlockwise manner round the triangle with vertices at **O(0,0), A(1,0), B(1,2)** by the use of Green's theorem.

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International Islámic University Chittagong
Department of Computer Science & Engineering
B.Sc. in CSE Semester Special Final Examination, Autumn-2018
Course Code: MATH-2401 Course Title: Mathematics-IV

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. Examine the Eigen Decomposition for the matrix, $A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ 10

2. a) Define Vector, Scalar, Vector field and Scalar field.
If $\vec{p} = 2\hat{\imath} - \hat{\jmath} + \hat{k},\ \vec{q} = \hat{\imath} + 3\hat{\jmath} - 2\hat{k},\ \vec{r} = -2\hat{\imath} + \hat{\jmath} - 2\hat{k},\ and\ \vec{s} = 3\hat{\imath} + 2\hat{\jmath} + 5\hat{k},$ 5
Find the scalars $a,\ b\ and\ c$ such that $\vec{s} = a\vec{p} + b\vec{q} + c\vec{r}$

   b) Define Vector and Scalar. Find the projection of the vector $\vec{A} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$ on the vector $\vec{B} = 4\hat{\imath} - 4\hat{\jmath} + 7\hat{k}$ 5

3. a) If $A = x^2yz\,\hat{\imath} - 2xz^3\hat{\jmath} + xz^2\hat{k}$ and $B = 2z\,\hat{\imath} + y\hat{\jmath} - x^2\hat{k}$ then find $\frac{\partial^2}{\partial x \partial y}(A \times B)$ at (1, 0, -2) 5

   b) A particle moves through 3-space in such a way that its velocity is $\vec{v}(t) = \hat{i} + 2t\,\hat{j} + t^2\,\hat{k}$. Find the co-ordinates of the particle at time $t = 1$ given that the particle is at the point **(1,2,3)** at time $t = 0$ 5

Group-B

4. a) Find $\vec{\nabla}\phi$ if (a) $\phi = \ln\left|\vec{r}\right|$ (b) $\phi = \frac{1}{\left|\vec{r}\right|}$ 5

   b) Show that $\nabla^2\left[\vec{\nabla}\cdot\left(\frac{\bar{r}}{r^2}\right)\right] = \frac{2}{r^4}$. *Where* $[\vec{\nabla}.(\phi\vec{A}) = \phi(\vec{\nabla}.\vec{A}) + (\vec{\nabla}\phi).\vec{A}\ \&\ \vec{\nabla} = \frac{\bar{r}}{r}\frac{\partial}{\partial r}]$ 5

5. a) How much work is accomplished by the force $\vec{F}(x,y) = xy\,\hat{i} + y^2\,\hat{j}$ in pushing a particle from (0,0) to (4,16) along the parabola $y = x^2$? 5

   b) Find the work done by a) $\vec{F} = x\,\hat{i} + y\,\hat{j}$ and b) $\vec{F} = \frac{3}{4}\hat{i} + \frac{1}{2}\hat{j}$ along the curve C traced by $\vec{r}(t) = \cos t\,\hat{i} + \sin t\,\hat{j}$ from $t = 0$ to $t = \pi$ 5

6. State Green's theorem. Verify Green's theorem in the plane for $\oint_c \{(xy \pm y^2)\,dx + x^2dy\}$ where C is the close curve of the region bounded by $y = x$ and $y = x^2$ 10

7. State Divergence's theorem. Verify the divergence theorem for the vector field $\vec{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$ taken over the region bounded by the planes, 10
$x = 0,\quad x = 1;\ y = 0,\quad y = 1;\ z = 0,\quad z = 1$

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International Islamic University Chittagong
Department of Computer Science & Engineering
B.Sc. in CSE Semester Final Examination, Spring-2018

Course Code: MATH-2401 Course Title: Mathematics-IV

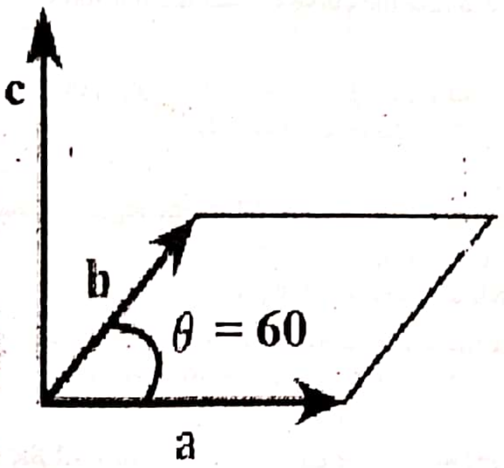
Marks: 50 Time: 2 hours & 30 minutes

[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. Examine the eigen decomposition for the matrix $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ 10

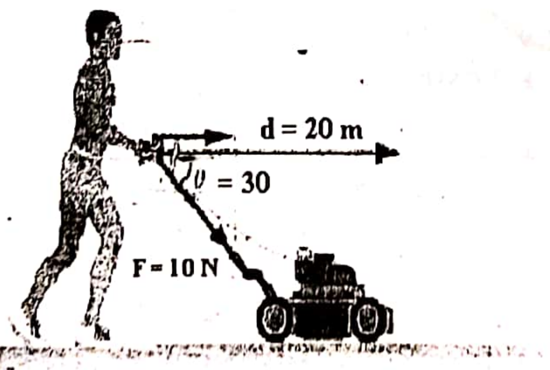
2. a) 2



What is the length of the vector $\vec{c}$?

Show the tangent vector of $\vec{r}(t) = t^2\,\hat{i} - t\,\hat{j}$ at $t = 3$ graphically and also find the unit tangent vector of $\vec{r}(t)$. 2

2



Find the work done

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Prove that, $\nabla^2(\ln r) = \frac{1}{r^2}$ 4

3. a) If $A = x^2yz\,\hat{\imath} - 2xz^3\hat{\jmath} + xz^2\hat{k}$ and $B = 2z\,\hat{\imath} + y\hat{\jmath} - x^2\hat{k}$ then find $\frac{\partial^2}{\partial x\,\partial y}(A \times B)$ at (1, 0, -2) 5

b) A particle moves through 3-space in such a way that its velocity is $\vec{v}(t) = \hat{i} + t\hat{j} + t^2\hat{k}$. Find the co-ordinates of the particle at time $t = 1$ given that the particle is at the point $(-1,2,4)$ at time $t = 0$ 5

Group-B

4. a) Prove that the angle between the surfaces at the point is equal to the angle between the normals to the surfaces at the point 5

b) Find the angle between the surfaces $x^2 + y^2 + z^2 = 2$ and $z = x^2 + y^2 - 1$ at the point (2,-1, 2) 5

5. a) Evaluate the line integral $\int_C xy\,dx$ along the curve C that the portion of $x^2 + y^2 = 1$ in the half circle. 5

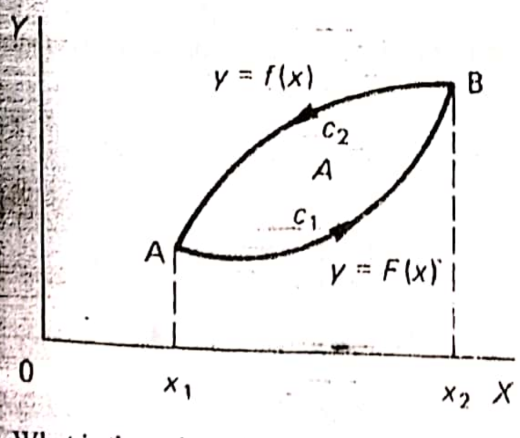
b) Find the work done by the force field $\vec{F}(x,y) = x^3y\,\hat{\imath} + (x-y)\hat{\jmath}$ on a particle that moves along the parabola, $y = x^2$ from $(-2,4)$ to $(1,1)$ 5

6. a) Evaluate $\int_v div\,\vec{F}\,dV$; Where $\vec{F} = x^2\hat{\imath} + z\hat{\jmath} + y\hat{k}$ and V is the region bounded by the planes, $x = 0,\ x = 1;\ y = 0,\ y = 3;\ z = 0,\ z = 2$ 5

b) State Green's theorem. Verify Green's theorem in the plane for $\oint_C \{(xy + x^2)\,dx + xy^2dy\}$ where the close curve of the region bounded by $x = y$ and $x = y^2$ 5

7. a) Evaluate $\iint \vec{F}.\hat{\eta}\,ds$; Where $\vec{F} = x^2\hat{\imath} + z\hat{\jmath} + y\hat{k}$ and S is the surface of the cube bounded by the planes, $x = 0,\ x = 1;\ y = 0,\ y = 3;\ z = 0,\ z = 2$ 8

b) 2



What is the value of A?

59

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بسم الله الرحمن الرحيم

International Islamic University Chittagong
Department of Computer Science & Engineering

B.Sc. in CSE Semester Final Examination, Autumn-2017

Course Code: MATH-2401 Course Title: Mathematics-IV

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. Solve the Linear system using LU decomposition. **10**
$2u_1 - u_2 + 3u_3 = 9,\ u_1 + u_2 + u_3 = 6,\ u_1 - u_2 + u_3 = 2$

2. a) Find the components of the vector $\vec{A} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$ on the vector $\vec{B} = 4\hat{\imath} - 4\hat{\jmath} + 7\hat{k}$ **5**

b) A particle moves along a curve whose parametric equations are, $x = t^2 + 1$, $y = 4t - 3$ & $z = 2t^2 - 6t$, where t is the time. **5**
(i) Determine the unit tangent vector at any time t
(ii) Find the unit tangent vector at t=2

3.

a) A particle moves through 3-space in such a way that its velocity is $\vec{v}(t) = \hat{i} + t\,\hat{j} + t^2\,\hat{k}$. Find the co-ordinates of the particle at time $t = 1$ given that the particle is at the point $(-1,2,4)$ at time $t = 0$ **7**

b) What would happen if crossing two vectors? Draw the resultant vector of $2\hat{i} \times 3\hat{j}$ **2**

c) Which is correct? **1**

i. $\nabla \vec{r} > d\vec{r}$

ii. $\nabla \vec{r} < d\vec{r}$

iii. $\nabla \vec{r} = d\vec{r}$

80 40

45 40

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Group-B

4\. a) Sketch the level curve for the function $f(x,y) = x^2 + y^2$ through the point (3, 4) and draw the gradient vector at this point 5

b) Find the angle between the surfaces $x^2 + y^2 - z^2 = 7$ and $z = x^2 - y^2 + 1$ at the point (2,-1, 2) 5

5\. a) Show that, $\vec{\nabla} = \frac{\vec{r}}{r}\frac{\partial}{\partial r}$; where $\vec{r}(x,y,z) = x\hat{i} + y\hat{j} + z\hat{k}$ is a position vector 3

b) Show that $\nabla^2(\ln r) = \frac{1}{r^2}$;where $\vec{\nabla}.(\phi\vec{r}) = \phi(\vec{\nabla}.\vec{r}) + (\vec{\nabla}\phi).\vec{r}$ 5

c) What is meant by $\vec{\nabla}\phi$ and $d\vec{r}$? *Where* ϕ is a scalar field and $\vec{r}(x,y,z) = x\hat{i} + y\hat{j} + z\hat{k}$ is a position vector? 2

6\. a) Evaluate the line integral $\int_C xy\,dx$ along the curve C that the portion of $x^2 + y^2 = 1$ in the half circle 5

b) If $\vec{F} = xy\hat{\imath} - z\hat{\jmath} + x^2\hat{k}$ and C is the curve $x = t^2,\ y = 2t,\ z = t^3$ *from* $t = 0$ *to* $t = 1$, then evaluate the line integral, $\int_C \vec{F} \times d\vec{r}$; where $\vec{r}(x,y,z) = x\hat{i} + y\hat{j} + z\hat{k}$ is a position vector 5

7\. Verify the divergence theorem for $\vec{A} = (2xy + z)\hat{\imath} + y^2\hat{\jmath} - (x + 3y)\hat{k}$ taken over the region bounded by $2x + 2y + z = 6,\ x = 0,\ y = 0,\ z = 0$ 10

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