National University
of Computer & Emerging Sciences
Islamabad

MT1006 – Differential Equations (Cal-II)

Assignment No: 02 **Individual Assignment**

Section: BS CS, BS AI, BS DS, BS CySec **Semester:** Spring 2022

Due date: As per GCR **Marks:** 14*10=140

Instructions:

1. Plagiarized work will result in zero marks.
2. No retake or late submission will be accepted.
3. Attach complete code, results, and screenshot for questions that require programming solution. Programs/codes should not be handwritten.
4. Questions that show the icon  require partial or complete solution using the approved programming tool.
5. The assignment is to be submitted in softcopy as well as in hardcopy.
6. The softcopy should be a single PDF file of your complete assignment including programming and non-programming questions.
7. The PDF file should be according to the following format: id_section_A1 e.g., i21123456_A_A1. A1 in the end denotes Assignment 1.
8. The images of by-hand solution should be properly scanned. You can use any mobile application such as Cam Scanner or Adobe Scan for scanning. Each of these applications allow you to export pdf or image files which you can use to combine with your programming solutions. Do not attach direct images from the camera application of your mobile phone, or screenshots.

Question 1:

A delivery company accepts only rectangular boxes the sum of whose length and width does not exceed 108 inches. Find the dimensions of an acceptable box of largest volume.

Question 2:

Find the absolute maxima and minima of the function on the given domain

$T(x, y) = x^2 + xy + y^2 - 6x + 2$ on the rectangular plane $0 \leq x \leq 5, -3 \leq y \leq 3$.

Question 3:

Use a software application to evaluate the integrals.

a) $$\int_0^1 \int_0^2 \frac{y - x}{(x + y)^3} dxdy$$

b) $$\int_{\pi/4}^{3\pi/4} \int_{\csc\theta}^{2\sin\theta} r\, dr\, d\theta.$$

c) $$\int_1^2 \int_0^{3x} \int_{2y}^{x} dzdydx$$

Question 4:

Find the volume of the region bounded above by the plane $z = y/2$ and below by the rectangle.

$$R : 0 \leq x \leq 4, 0 \leq y \leq 2$$

Question 5 :

Evaluate $\iiint_E 6z^2 dV$ where E is the region below $4x + 2y + 2z = 10$ in the first octant.

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Question 6:

Sketch the region of integration.

$$\int_0^2 \int_{y-2}^{0} dxdy$$

Question 7:

Determine the average value of $\boldsymbol{F(x,y,z) = xyz}$ throughout the cubical region D bounded by the coordinate planes and the planes $\boldsymbol{x = 2, y - 2, z = 2}$ in the first octant.

Question 8:

Evaluate the integral.

$$\int_0^{\pi}\int_0^{\pi}\int_0^{\pi} \cos(u+v+w)\ du\ dv\ dw$$

Question 9:

Find $favg$ for the functions given on the interval and determine the value of c in the given interval for which $f(c) = favg$.

a) $f(x) = 9 - 2e^{4x+1}\ on\ [2,6]$

b) $8 - \cos\left(\frac{x}{4}\right)\ on\ [0\ 4\pi]$

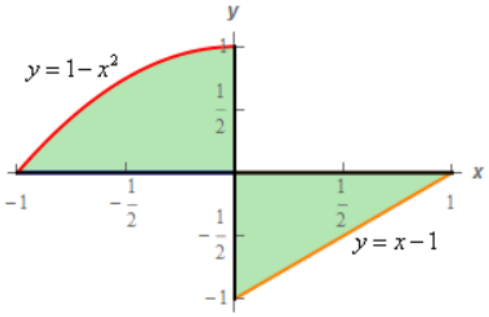
Question 10:

The velocity of a particle moving on the x-axis is given by $v(t) = t^3 - 6t^2$ for the time interval $0 \le t \le 10$.

a) When is the particle farthest to the left?
b) When is the velocity of the particle increasing the fastest?

Question 11:

Evaluate $\iint_D\ 12x^3 - 3dA$ over D where D is the region shown below.



Question 12:

Determine the volume of the region that is between the xy plane and $f(x,y) = 1 + y^5 + \sqrt{x^4+1}$ and is above the region in the xy plane that is bounded by $y = \sqrt{x}, x = 2$ and the x-axis.

Question 13:

Evaluate:

a) $\iint_D (e^{y^2} + 1)dA$ where D is the triangle with vertices (0,0), (-2,4) and (8,4).

b) $\iint_D x^5 \sin(y^4)\, dA$ where D is the region in the 2nd quadrant bounded by $y = 3x^2, y = 12$ and the y-axis.

Question 14:

The temperature at a point is given by $T = xyz$. Find the average temperature in the cube with opposite corners at (0,0,0) and (2,2,2).