MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS)
SECOND SEMESTER EXAMINATION
(2024 ADMISION ONWARDS)
MG2DSCMAT100-A Gateway to Mathematics

Duration: 2 hrs Maximum Marks: 70

Students should attempt atleast one question from each course outcome to enhance their overall outcome attainability.

Part A
Answer any five questions. Each question carries 2 marks

1. Find $\frac{\partial f}{\partial y}$ if $f(x,y) = ysin(xy)$. [U][1]
2. State the chain rule for functions of one independent variable and two intermediate variables. [K][1]
3. Evaluate $\int_0^2 (x-1)dx$. [A][2]
4. State the fundamental theorem of calculus (part 1). [K][2]
5. Give an example of a linear system of 3 equations in 3 unknowns. [K][3]
6. What are the elementary row operations of a matrix. [A][3]
7. Draw a non-simple graph with no multiple edges, each with five vertices and eight edges. [U][4]
8. Draw a 4 regular connected graph. [U][4]

Part B
Answer any five questions. Each question carries 6 marks

9. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ at $(0,0,0)$, using formula for implicit differentiation, if $x^3 + z^2 + ye^{xz} + zcosy$. [U][1]
10. Find the local extreme values (if any) of $f(x,y) = y^2 - x^2$. [U][1]
11. Evaluate $\int_0^2 (5 - 3\sqrt{1-x^2})dx$. [A][2]
12. Evaluate the double integral $\int \int_A y^2 x dA$ over the rectangle $R = \{(x,y) : -3 \leq x \leq 2, 0 \leq y \leq 1\}$. [A][2]
13. What are the different types of solutions a system of equations can have? Explain using Gaussian elimination. [U][3]

14. Use Gaussian elimination to determine whether the following system is consistent and, if so, find the solution:

$$\begin{aligned} x + y = z &= 6 \\ 2x - y + 3z &= 14 \\ 3x + 4y + 5z &= 26. \end{aligned}$$

. [A][3]

15. Define and differentiate between null graph, complete graph, cyclic graph, path graph, and wheel graph with examples. [A][4]

16. What is a subgraph? Explain the difference between spanning subgraph and induced subgraph with examples. [A][4]

Part C
Answer any three questions. Each question carries 10 marks

17. Find the absolute maximum and minimum values of $f(x, y) = 2 + 2x + 2y - x^2 - y^2$ on the triangular region in the first quadrant bounded by the lines $x = 0, y = 0, y = 9 - x$. [U][1]

18. Use a double integral to find the volume of the solid that is bounded above by the plane $z = 4 - x - y$ and below by the rectangle $R = [0, 1] \times [0, 2]$. [A][2]

19. Find the area under the curve $y = f(x)$ over the stated interval.

    (a) $f(x) = x^3$ over $[2, 3]$.

    (b) $f(x) = x^{-\frac{2}{3}}$ over $[1, 27]$.

    [A][2]

20. Solve the following system of equations using Gaussian elimination:

$$\begin{aligned} 2x + y - z &= 8 \\ -3x - y + 2z &= -11 \\ -2x + y + 2z &= -3. \end{aligned}$$

[A][3]

21. Write down the adjacency and incidence matrices of the graph K_5. [A][4]

22. Draw any five simple cubic graphs with at most 8 vertices. [A][4]