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Reg.No : .....

Name : .....

**MAHATMA GANDHI UNIVERSITY, KOTTAYAM**  
**MGU-UGP (HONOURS) REGULAR EXAMINATION MARCH 2025**

**SECOND SEMESTER**

**Discipline Specific Core Course (DSC) - MG2DSCMAT100 - A GATEWAY TO  
MATHEMATICS**

(2024 ADMISSION ONWARDS)

**Duration: 2 Hours**

**Maximum Marks: 70**

*Remember(K), Understand(U), Apply(A), Analyse(An), Evaluate(E), Create(C), Skill(S), Interest(I)  
and Appreciation(Ap)*

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

**Part A**

Short answer type Questions

Answer any 5 questions

Each question carries 2 marks

1. If  $f(x, y) = 10x^3 + 12y^4$  then find  $\frac{\partial f}{\partial x}$  and  $\frac{\partial f}{\partial y}$ . [U] / [CO1]
2. Define critical points of a function of two variables with an example. [U] / [CO1]
3. Define regular partition of an interval. [A] / [CO2]
4. Find  $\frac{d}{dx} \left[ \int_a^x f(t) dt \right]$ . [U] / [CO2]
5. How many rows and columns does the coefficient matrix have, if there are  $m$  equations in  $n$  unknowns? [A] / [CO3]
6. Define an inconsistent system of equations. [U] / [CO3]
7. Define the adjacency matrix of a graph. [K] / [CO4]
8. How many edges does  $W_8$  have? [A] / [CO4]

**[2x5 = 10]**

**Part B**

### Short Essay Type Questions

Answer any 5 questions

Each question carries 6 marks

9. Find  $\frac{dy}{dx}$  at  $(0, \ln 2)$  if  $xe^y + \sin xy + y - \ln 2 = 0$ . [U] / [CO1]
10. Using the chain rule, find  $\frac{\partial T}{\partial r}$  and  $\frac{\partial T}{\partial \theta}$  if  
 $T = x^2y - xy^3 + 2$ ,  $x = r \cos \theta$  and  $y = r \sin \theta$ . [U] / [CO1]
11. Evaluate  $\int_{-1}^1 \int_0^2 (4 - x^2 - y^2) dy dx$ . [A] / [CO2]
12. Evaluate  $\int_0^{\pi/3} \int_0^{\pi/6} \sin(2x) \cos(3y) dy dx$ . [A] / [CO2]
13. Using the Gauss elimination method to find the nature of the solution:  
 $x - y + z = 4$   
 $x - 2y - 2z = 9$   
 $2x + y + 3z = 1$  [A] / [CO3]
14. Find the solution of the linear system of equations using the Gauss elimination method  
 $x + y + z = 3$   
 $x + 2y + 3z = 4$   
 $x + 4y + 9z = 6$  [A] / [CO3]
15. How many vertices and edges  $K_{r,s}$  will have? [U] / [CO4]
16. Show that a simple graph with at least two vertices must contain two or more vertices of the same degree. [An] / [CO4]

[6x5 = 30]

### Part C

Essay Type Questions

Answer any 3 questions

Each question carries 10 marks

17. Find the absolute maximum and minimum value of  $f(x, y) = x^2 + y^2$  on the triangular region in the first quadrant bounded by the line  $x = 0$ ,  $y = 0$  and  $y + 2x = 2$ . [U] / [CO1]
18. (a) State the Fundamental Theorem of Calculus, Part 1. [A] / [CO2]  
 (b) Find  $\int_0^4 f(x) dx$  if  $f(x) = \begin{cases} \sqrt{x}, & 0 \leq x < 1 \\ \frac{1}{x^2}, & 1 \leq x \leq 4 \end{cases}$
19. Use properties of definite integrals and appropriate formulas from geometry to evaluate the integral  $\int_0^1 (5 - 3\sqrt{1-x^2}) dx$ . [A] / [CO2]



20. Solve the following system of equations using Gauss elimination and back substitution.

[A] / [CO3]

(a)  $2x + 5y = 2$   
 $4x - 3y = 30$

$x - y + z = 0$   
(b)  $-x + y - z = 0$   
 $10y + 25z = 90$   
 $20x + 10y = 80$

21. (a) Define an edge-deleted subgraph and a vertex-deleted subgraph of a graph. Illustrate your definition using examples.

[U] / [CO4]

(b) Draw the graphs  $C_6 - v$  and  $C_6 - e$  where  $v \in V(C_6)$  &  $e \in E(C_6)$ .

(c) Is  $C_6$  a subgraph of  $C_6$ ?

22. (a) Draw a non-simple graph with vertex set

[U] / [CO4]

$V = \{A, B, C, D, E, F, G, H\}$  and edge set

$E = \{AA, CC, FF, AB, BC, CD, DE, EF, FG, GH, HA\}$ .

(b) Identify and list all loops in the graph.

[10x3 = 30]