



**K. K. Wagh Institute of Engineering Education & Research, Nashik**  
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2024	
Exam Seat No.:	
Academic Year:2024-2025	Semester:I
Class:FY	Program:B.Tech
Branch Code:FYE	Pattern:2023
Name of Course:Linear Algebra and Differential Calculus	Course Code:2300101A
Max. Marks:60	Duration:2.30 Hrs.

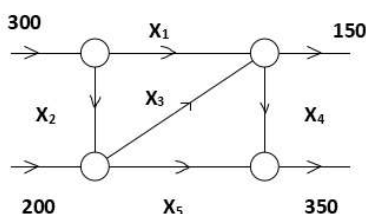
**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 3 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. Use of non-programmable pocket calculator is allowed.
6. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Marks CO**

**Question No. 1**

- 1 Solve the traffic problem in the given network. (6) CO3



**Question No. 2**

- 2 Reduce the matrix  $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$  to diagonal form, also write Modal matrix & Spectral Matrix (6) CO3

**Question No. 3**

- 3.a) If  $u = Ae^{-gx} \sin(nt-gx)$  Find  $\frac{\partial u}{\partial x}$ ,  $\frac{\partial u}{\partial t}$  (4) CO2

**OR**

- 3.b) If  $u = x^y$  then prove that  $u_{xy} = u_{yx}$  (4) CO2

- 3.c) If  $u = \sin \frac{xy}{x^2+y^2} + \sqrt{x^2+y^2} + \frac{x^2y}{x+y}$ , Find  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$  (6) CO3

**OR**

- 3.d) If  $u = \tan^{-1} \left( \frac{x^3+y^3}{x+y} \right)$  prove that  $x^2 \frac{\partial^2 u}{\partial^2 x} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial^2 y} = (1 - 4\sin^2 u)\sin 2u$  (6) CO3

- 3.e) If  $z = f(u, v)$ ,  $u = x^2 - 2xy - y^2$  &  $v = y$  show that  $(x+y) \frac{\partial z}{\partial x} + (x-y) \frac{\partial z}{\partial y} = (x-y) \frac{\partial z}{\partial u}$  (6) CO3

3.f) If  $u=f(x, y, z)$  then prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$  (6) CO3

**Question No. 4**

4.a) If  $x+y+z=u$ ,  $y+z=uv$ ,  $z=uvw$  find  $\frac{\partial(x,y,z)}{\partial(u,v,w)}$  (5) CO3

**OR**

4.b)  $u = \frac{x+y}{1-xy}$ ,  $v = \tan^{-1} x + \tan^{-1} y$  Verify whether  $u, v$  are functionally dependent. If so find the relation between them. (5) CO3

4.c) In calculating the volume of a right circular cone, error of 2% & 1% are found in measuring height & radius respectively. find the percentage error in calculating the volume. (5) CO5

**OR**

4.d) The area of a triangle ABC is calculated from the formula  $\Delta = \frac{1}{2}bc \sin A$ . Error of 1%, 2%, 3% respectively are made in measuring  $b, c, A$ . If the correct value of  $A$  is  $45^\circ$ , find the % error in the calculated value of triangle. (5) CO5

4.e) Discuss the condition of maxima & minima for the function  $f(x,y) = 3x^2 - y^2 + x^3$  (6) CO5

**OR**

4.f) Use Lagrange's method to find minimum distance from the origin to the plane  $3x+2y+z=12$  (6) CO5

**Question No. 5**

5.a) A committee of 10 students has to be selected from 8 boys and 6 girls. How many ways we can select committee member if (5) CO3

i) A committee consist of same no of boys and girls.

ii) At least 3 girls are there.

**OR**

5.b) A room has three electric lamps. From a collection of 10 electric bulbs of which 6 are good, three are selected at random & put in the lamps. Find the probability that the room is lighted. (5) CO3

5.c) From a group of 3 Indian, 4 Pakistani & 5 Americans, a sub committee of four people is selected by lots. Find the probability that the sub committee will consist of (5) CO2

i) Two Indian, two Pakistani

ii) One Indian, one Pakistani, two American

iii) Four American

**OR**

5.d) If A & B are mutually exclusive event,  $P(A)=0.35$ ,  $P(B)=0.45$  Find (5) CO2

a)  $P(A')$

b)  $P(B')$

c)  $P(A \cup B)$

d)  $P(A \cap B)$

e)  $P(A' \cap B')$

5.e) Three factories produce light bulbs to supply the market. Factory A produces 20%, 50% of the tools are produced in factories B and 30% in factory C. 2% of the bulbs produced in factory A, 1% of the bulbs produced in factory B and 3% of the bulbs produced in factory C are defective. A bulb is selected at random in the market and found to be defective. What is the probability that this bulb was produced by factory B. (6) CO3

**OR**

- 5.f) The content of three Urns are 1 white, 2 red, 3 green balls; 2 white, 1 red, 1 green ball & 4 white, 5 red, 3 green balls. Two balls are drawn from an Urn chosen at random, these are found to be one white & one green. Find the probability that balls so drawn came from the third Urn. (6) CO3

**..... End of question paper.....**