



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

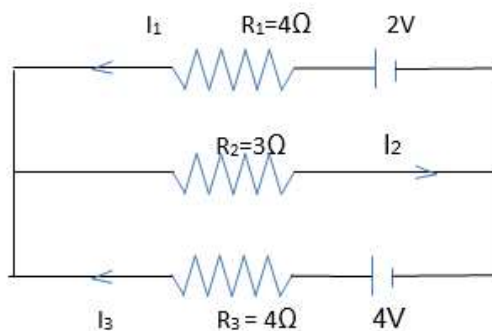
SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:I
Class:FY	Program:B.Tech
Branch Code:FYE	Pattern:2022
Name of Course:Applied Mathematics - I	Course Code:FYE221001
Max. Marks:60	Duration:2.30 Hrs.

**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 pages.
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 nonprogrammable pocket calculator is allowed.
6. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Question No. 1 Attempt following Question**

- 1 Determine the current in the network given in fig. (6) CO3



**Question No. 2 Attempt following Question**

- 2 Reduce the matrix A to diagonal form, also write Modal Matrix and Spectral Matrix. (6) CO3

$$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$

**Question No. 3 Attempt following Question**

- 3.a) If  $u = Ae^{-gx} \sin(nt - gx)$  find  $u_x, u_y$ . (4) CO2

OR

3.b) If  $u = \log(x^3 + y^3 + z^3 - 3xyz)$  then find  $u_x, u_y, u_z$ . (4) CO2

3.c) If  $u = \tan^{-1} \frac{y^2}{x}$  Then Prove that  $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -\sin^2 u \cdot \sin 2u$ . (6) CO3

OR

3.d) If  $z = x \cos(\frac{y}{x}) + \sin(\frac{y}{x})$  Prove that  $x^2 \frac{\partial^2 z}{\partial x^2} + 2xy \frac{\partial^2 z}{\partial x \partial y} + y^2 \frac{\partial^2 z}{\partial y^2} = 0$ . (6) CO3

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

OR

3.f) If  $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$  then, show 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 Attempt following Question

4.a) If  $x = u + v, y = v^2 + w^2, z = w^3 + u^3$  Find,  $\frac{\partial u}{\partial x}$ . (5) CO3

OR

4.b)  $u = \sin^{-1} x + \sin^{-1} y, v = x\sqrt{1 - y^2} + y\sqrt{1 - x^2}$  Verify whether  $u, v$  are functionally dependent. If so, find relation between them. (5) CO3

4.c) Find the possible percentage error in computing the parallel resistance  $r$  of two resistances  $r_1$  and  $r_2$  from the formula  $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$ , where  $r_1$  and  $r_2$  are both in error by 8% each. (5) CO5

OR

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

4.e) Discuss the conditions of maxima and minima for the function  $f(x, y) = x^3 + y^3 - 3axy$ . (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 Attempt following Question

5.a) A student is to answer 10 out of 13 questions in an exam, (5) CO2

(i) How many choices has he, if he must answer the first or second question but not both.

(ii) How many choices has he, if he must answer exactly 3 out of first 5 questions.

OR

5.b) From 6 Engineers and 5 Architects a committee is to be formed having 3 Engineers and 2 Architects. How many different committees can be formed if, (5) CO2

(i) There is no restriction.

(ii) 2 particular Engineers must be included.

5.c) A problem in statistics is given to three students A, B, C, whose chances of solving it are  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$  respectively. Find the probability that, (5) CO2

(i) All of them solve the problem.

(ii) Problem is solved.

**OR**

5.d) If A and B are not mutually exclusive events,  $P(A)=1/4$ ,  $P(B)=2/5$ , and  $P(A \cup B)=1/2$  then find, (5) CO2

(a)  $P(A')$

(b)  $P(B')$

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

(d)  $P(A \cap B)$

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

5.e) Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from Bag II. (6) CO3

**OR**

5.f) The contents of three urns are 1 White, 2 Red, 3 Green balls; 2 White, 1 Red, 1 Green ball and 4 White, 5 Red, 3 Green balls. Two balls are drawn from an urn chosen at random, these are found to be one white and one Green. Find the probability that balls so drawn came from the third Urn. (6) CO3

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