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PYQs of Linear Algebra

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#1 Educator in Chemical Engineering · GATE & ESE

Working in the field of gate chemical engineering from last 10 years, completed my Masters from IIT Delhi. Am very passionate about teaching

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Educator highlights

- Worked at **The Gate Coach**
- Studied at **IIT Delhi**
- Taught over 10000+ students of chemical engineering in the duration of 8 years with a qualifying gate percentage of more than 85% HOD of the chemical engineering in the last institute i worked on.
- Lives in **Delhi Cantt., Delhi, India**
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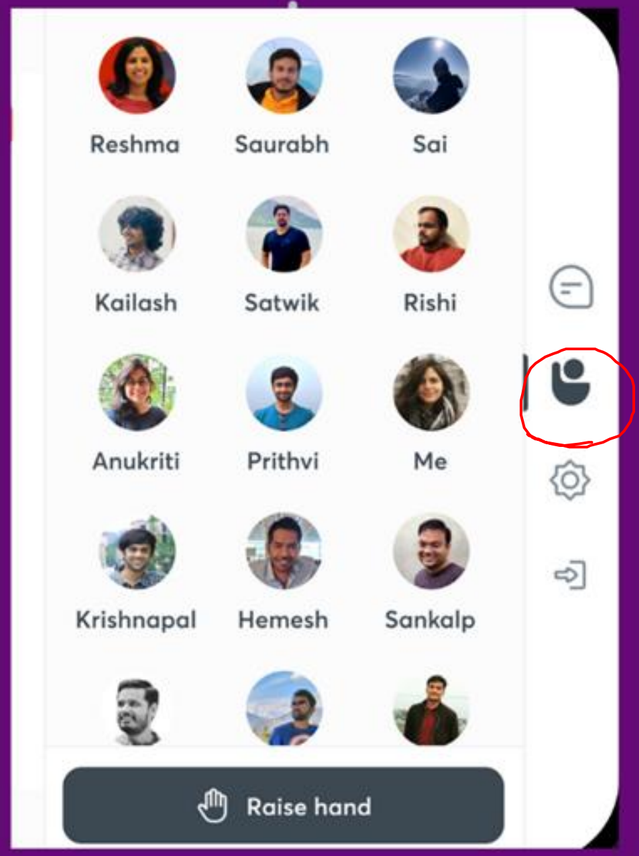

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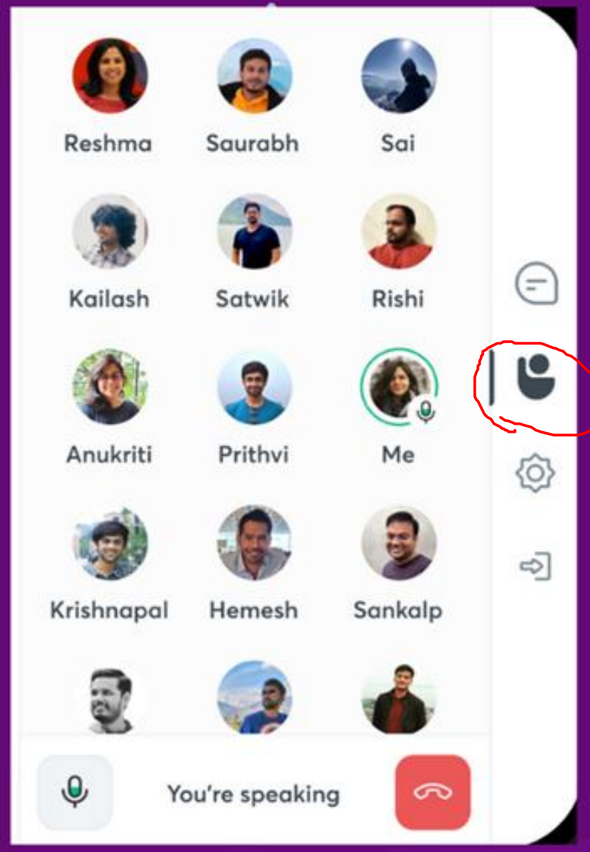

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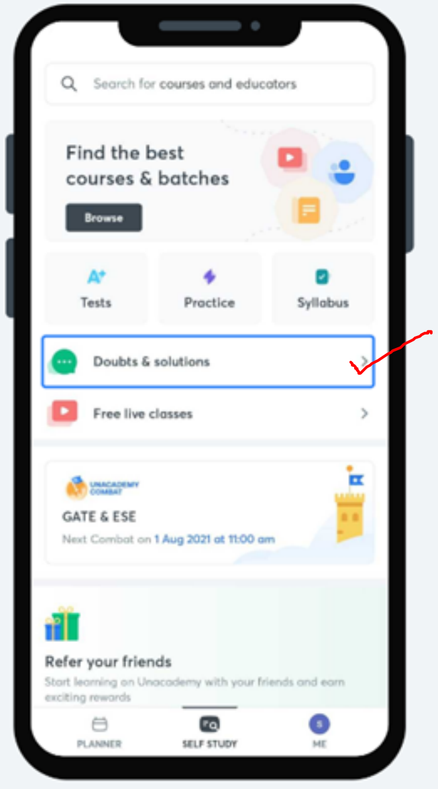

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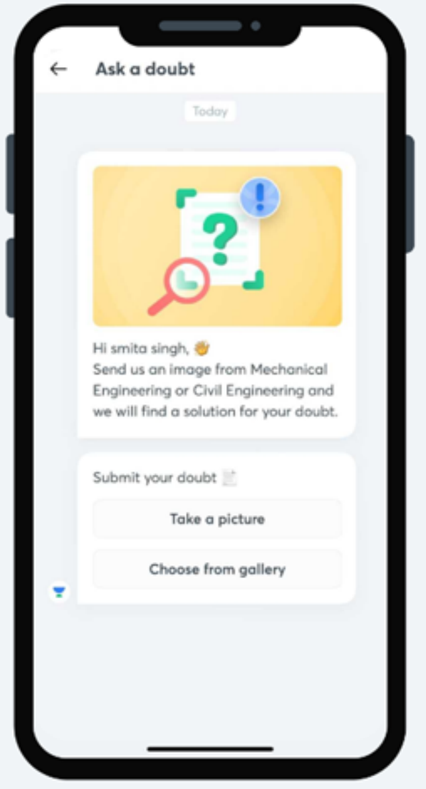

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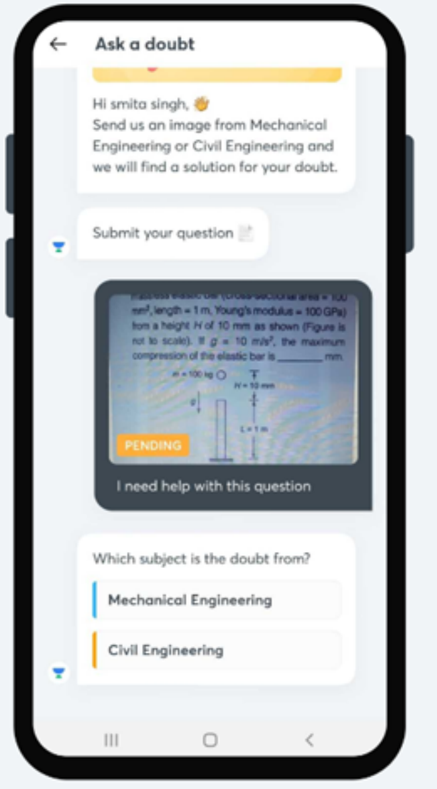

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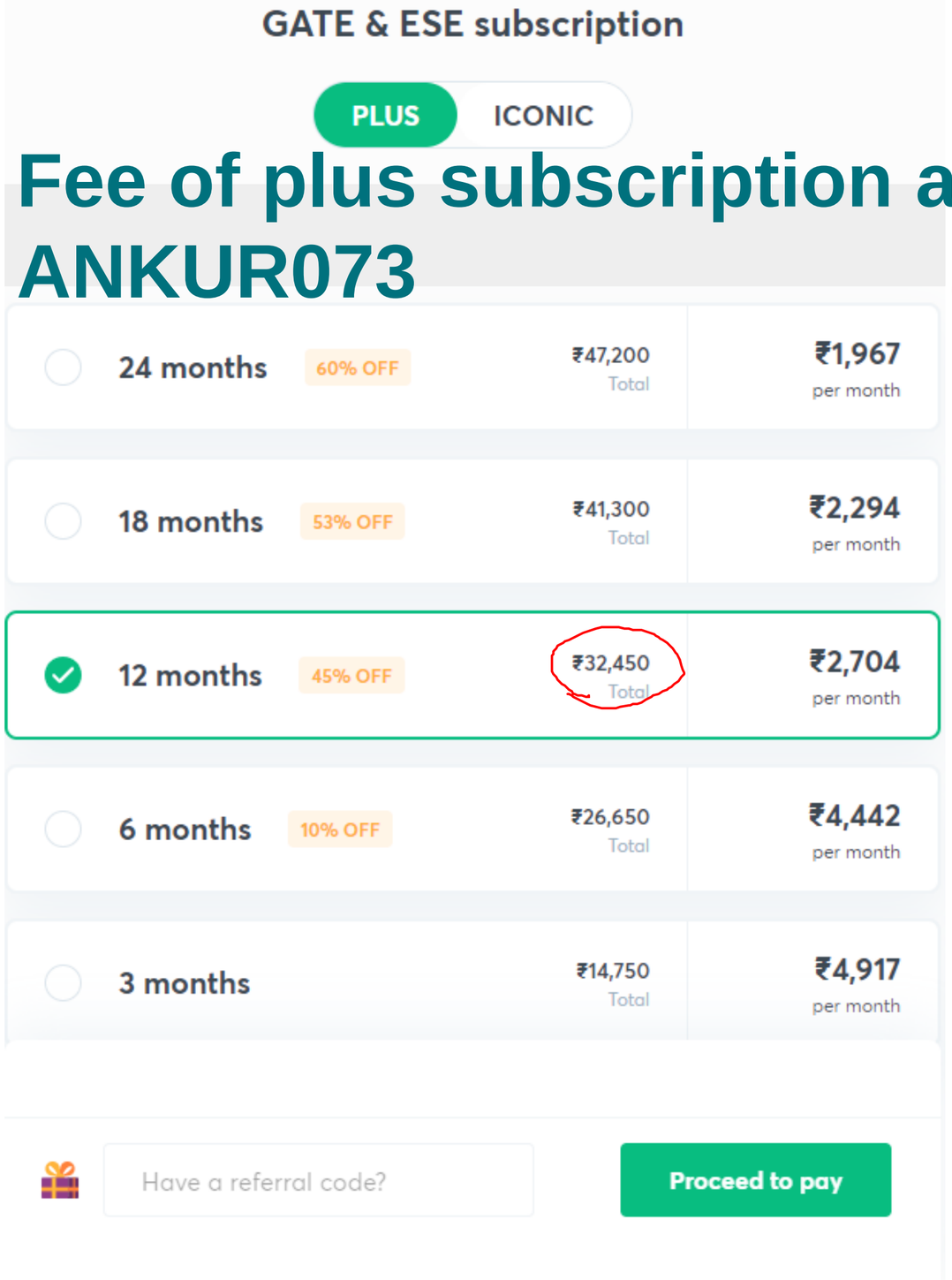

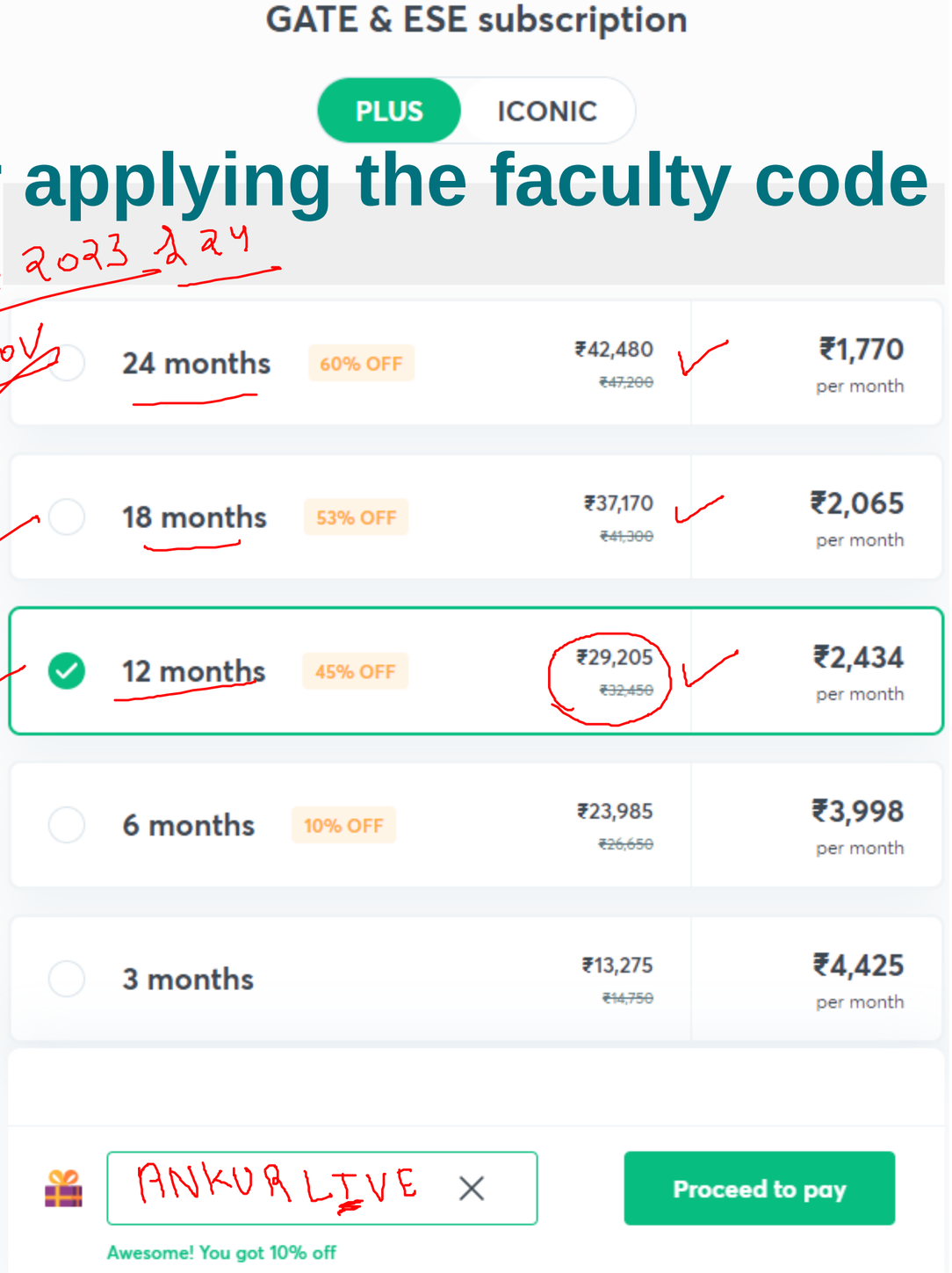

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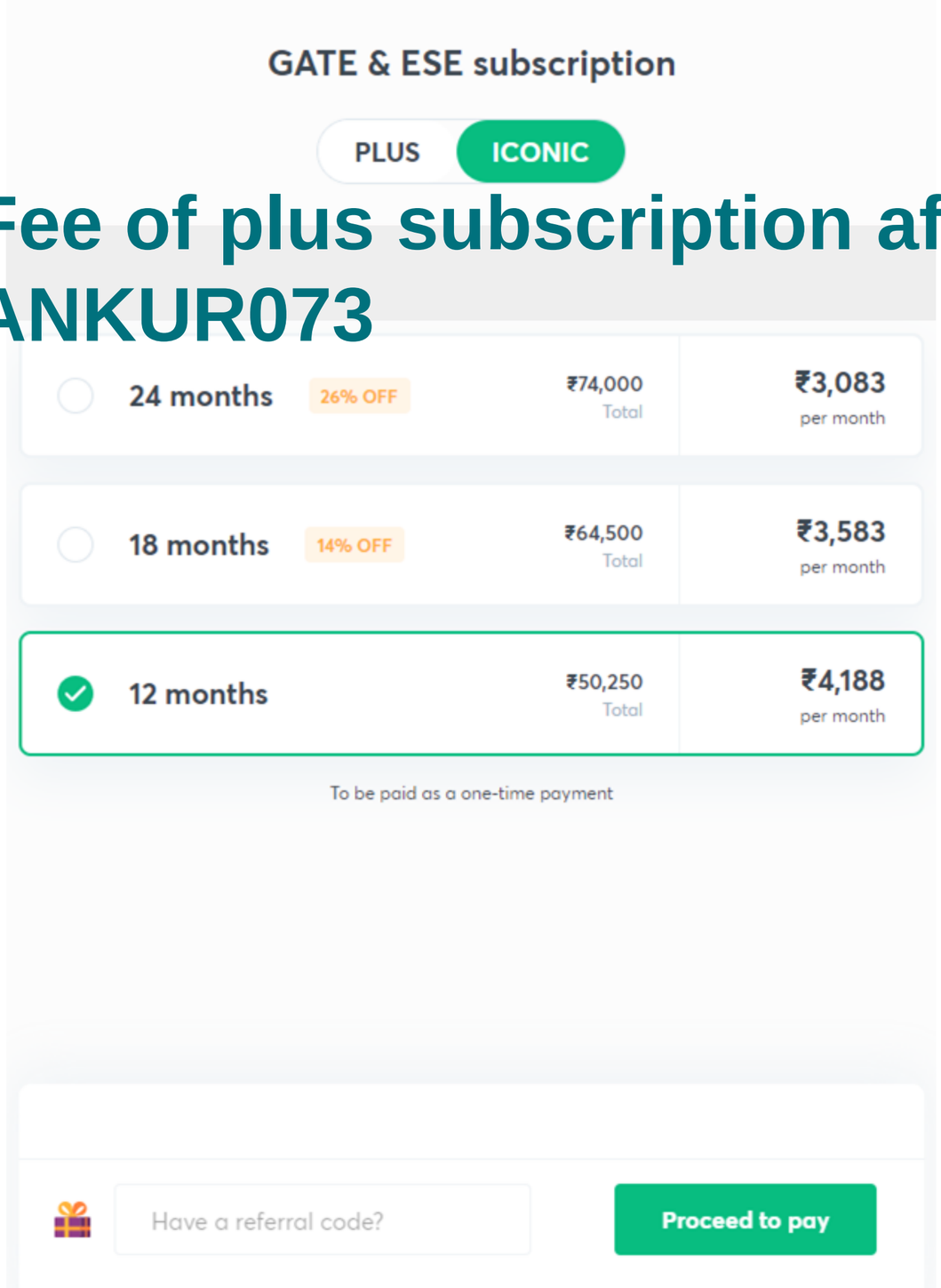

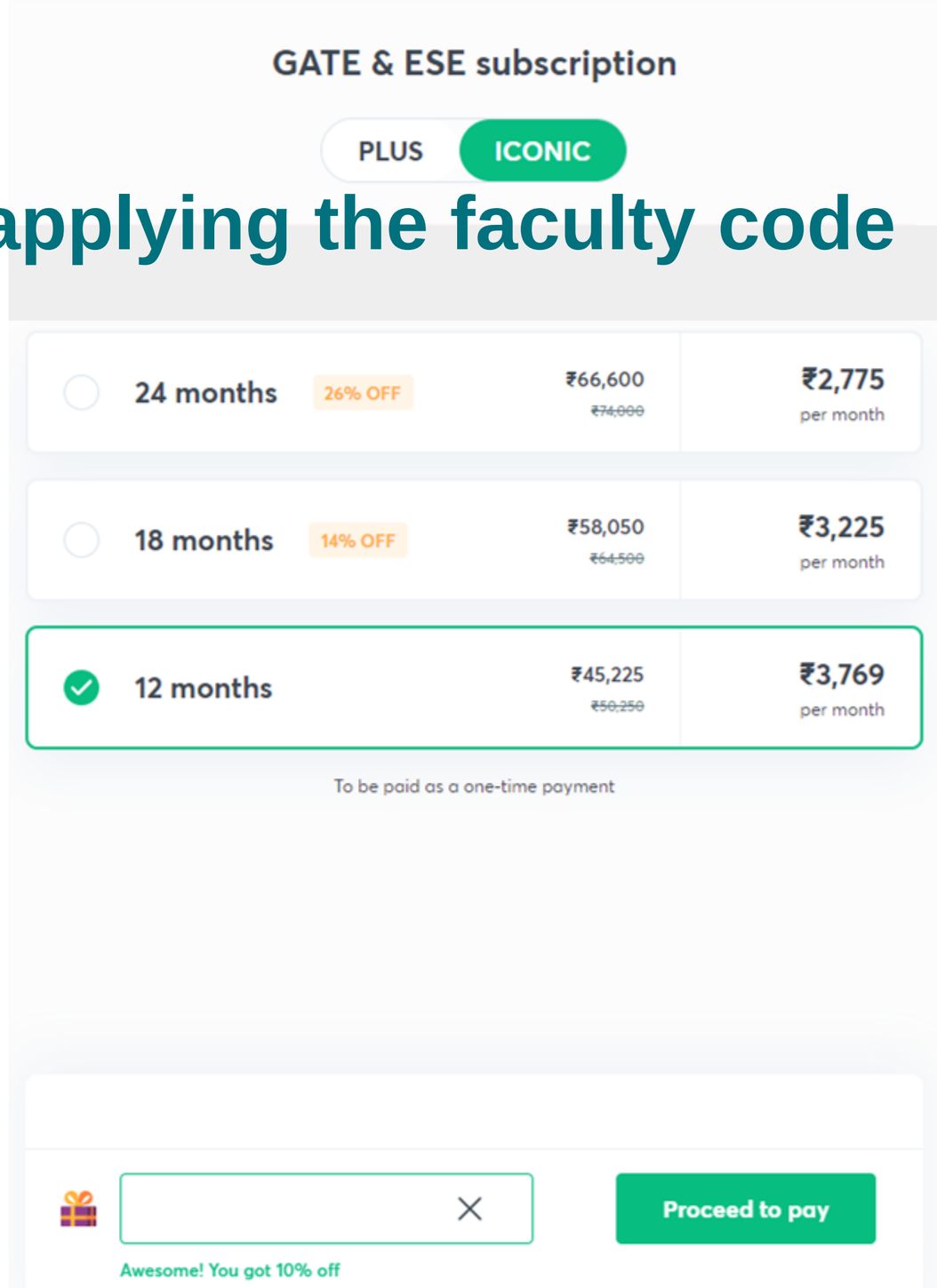

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Timetable for Ankur Bansal

	09:00 PM	
5th July	Two film theory	Link of the class
6th July	Minimum reflux ratio	Link of the class
7th July	Single stage extraction	Link of the class
8th July	Counter current Absorption	Link of the class
9th July	Time of Drying	Link of the class

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June Plan	
5th June	GATE Exam & Benefits
6th June	Top Colleges for M.Tech
8th June	GATE Preparation Strategy & Planning
10th June	PSUs via GATE
12th June	Detailed analysis of Mass transfer operation
13th June	Detailed analysis of Heat transfer operation
15th June	PYQs of Heat Transfer
17th June	PYQs of Heat Transfer
19th June	Detailed analysis of Instrumentation and Process Control
20th June	Detailed analysis of Fluid Mechanics
22th June	PYQs of Heat Transfer
24th June	PYQs of Heat Transfer
26th June	Detailed analysis of Thermodynamics
27th June	Ask Me Anything
29th June	PYQs of Heat Transfer

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Oil AND Fats Industry

Mass Transfer practice questions

Direct and indirect acting control valve part 1

Direct and indirect acting control valve part 2

- Fourier number (N_{Fo}): $k\theta/\rho C_p L^2$ is the ratio of the rate of heat transfer by conduction to the rate of energy storage in the system.
- Prandtl number (N_{Pr}): $C_p\mu/k$ is the ratio of momentum diffusivity (μ) and thermal diffusivity. Since it is a material property, Prandtl number depends only on the physical conditions (temperature and pressure) that a material is held at, not on the system in which it is placed.
- Peclet number ($N_{Re} \times N_{Pr}$): $DV\rho C_p/k$ is the convective transport/diffusive transport.
- Nusselt number (N_{Nu}): hD/k is the ratio of convective heat transfer to conductive heat transfer in the fluid perpendicular to flow direction. Measures enhancement of heat transfer from a surface that occurs in a real situation compared to heat transferred if only conduction occurred. Nusselt number conveys how important convection is compared to conduction. It involves a heat transfer coefficient and a characteristic length, both of which depend on the type of system one is using.
- Grashof number (N_{Gr}): $L^3\rho^2\beta g\,\Delta t/\mu^2$ is the ratio of buoyancy force to viscous force acting on a fluid. L is characteristic length. It is generally used to model natural convection.
- Rayleigh number (N_{Ra}): $N_{Gr} \times N_{Pr} = L^3\rho^2 g\beta C_p \Delta T/\mu\alpha$ is the quantity that governs natural convection heat transfer.
- Graetz number (N_{Gz}): $WC_p/kL = D_i/LN_{Re} \times N_{Pr}$ characterizes laminar flow in a conduit. Ratio of the sensible heat change of the flowing fluid to the rate of heat conduction through a film of thickness D or L.
- Biot number (N_{Bi}): hL/k is the ratio of the internal thermal resistance to the external thermal resistance. It represents the relative importance of the thermal resistance within a solid body.
- Stanton number (N_{St}): $h/C_pV\rho = N_{Nu}/N_{Re} \times N_{Pr}$ measures the ratio of the heat transferred into a fluid to the thermal capacity of the fluid. Used in forced convection.

Q6. The sum of the eigen values of the matrix $\begin{bmatrix} 3 & 4 \\ x & 1 \end{bmatrix}$ for real and negative values of x is

(A) Greater than zero

(B) less than zero

(C) zero

(D)dependent on the value of x

Q7. The system of equations

$4x + 6y = 8$

$7x + 8y = 9$

$3x + 2y = 1$ has

(A) No solution

(B) Only one solution

(C) Two solutions

(D) Infinite number of solutions

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Q17. How many solutions does the following system of equations have?

$$4x + 2y + z = 7$$
$$x + 3y + z = 3$$
$$3x + 4y + 2z = 2$$

(A) 0
(B) 1
(C) 2
(D) ∞

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Q18. The matrix A is given by $A = \begin{bmatrix} 1 & 4 \\ a & 2 \end{bmatrix}$ the eigen values of the matrix A are real and non negative for the condition

(A) $-\frac{1}{16} \leq a \leq \frac{1}{16}$

(B) $-\frac{1}{2} \leq a \leq \frac{1}{2}$

(C) $-\frac{1}{2} \leq a \leq \frac{1}{16}$

(D) $-\frac{1}{16} \leq a \leq \frac{1}{2}$

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Q31. If the following represents the equation of a line

$$\begin{vmatrix} x & 2 & 4 \\ y & 8 & 0 \\ 1 & 1 & 1 \end{vmatrix} = 0$$

Then the line passes through the point

(A) $(0,0)$
(B) $(3,4)$
(C) $(4,3)$
(D) $(4,4)$

Q32. If $A = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$ then the eigen values of A^3 are

(A) 27 and 8

(B) 64 and 1

(C) 12 and 3

(D) 4 and 1

Q42. The value of ‘a’ for which the following set of equations

$y + 2z = 0$

$2x + y + z = 0$

$ax + 2y = 0$

Have non-trivial solution, a is

(A)0
(B)8
(C)-2
(D)3

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Q46. $\bar{\bar{A}}$ and $\bar{B}$ are two 3×3 matrix such that $\bar{\bar{A}} = \begin{bmatrix} -2 & 4 & 6 \\ 1 & 2 & 1 \\ 0 & 4 & 4 \end{bmatrix}, \bar{\bar{B}} = 0$

and $\bar{\bar{A}} = \bar{\bar{B}} = 0$ then the rank of matrix $\bar{\bar{B}}$ is

(A) $r = 2$

(B) $r < 3$

(C) $r \leq 3$

(D) $r = 3$

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Q61. If $A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$, then the eigen values of A^3 are

(A) 5,4
(B) $3, -1$
(C) $9, -1$
(D) $27, -1$

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Q72. The eigen values of matrix $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ are 5 and -1 then the eigen values of $(-2A + 3I)$ (I is a 2×2 identity matrix) are

(A) -7 and 5

(B) -5 and 7

(C) $-\frac{1}{7}$ and $\frac{1}{5}$

(D) $\frac{1}{7}$ and $-\frac{1}{5}$

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Q76. The inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is

(A) $\begin{bmatrix} -2 & -1 \\ -3/2 & -1/2 \end{bmatrix}$

(B) $\begin{bmatrix} -2 & 3/2 \\ 1 & -1/2 \end{bmatrix}$

(C) $\begin{bmatrix} -2 & 1 \\ 3/2 & -1/2 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & -3/2 \\ -1 & 1/2 \end{bmatrix}$

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Q87. Let $\lambda_1 = -1$ and $\lambda_2 = 3$ be the eigen values and $\bar{v}_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\bar{v}_2 = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ be the corresponding eigen vectors of a real 2×2 matrix $\bar{\bar{R}}$. Given that $\bar{\bar{p}} = (\bar{v}_1, \bar{v}_2)$. Which one of the following matrices represents $\bar{\bar{P}}^{-1}\bar{\bar{R}}\bar{\bar{P}}$

(A) $\begin{pmatrix} 0 & -1 \\ 3 & 0 \end{pmatrix}$

(B) $\begin{pmatrix} 0 & 3 \\ -1 & 0 \end{pmatrix}$

(C) $\begin{pmatrix} 3 & 0 \\ 0 & -1 \end{pmatrix}$

(D) $\begin{pmatrix} -1 & 0 \\ 0 & 3 \end{pmatrix}$

Q93. Consider the following set of linear algebraic equations

$x_1 + 2x_2 + 3x_3 = 2$

$x_2 + x_3 = -1$

$2x_2 + 2x_3 = 0$

The system has

(A) A unique solution

(B) No solution

(C) An infinite number of solution

(D) Only the trivial solution

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Q97. Consider the following (2×2) matrix $\begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix}$. Which one of the following vectors is NOT a valid eigen vector of the above matrix?

(A) $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$

(B) $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$

(C) $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

(D) $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

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Q103. Which of the following statements are TRUE?

P. The eigenvalues of a symmetric matrix are real

Q. The value of the determinant of an orthogonal matrix can only be $+1$

R. The transpose of a square matrix A has the same eigenvalues as those of A

S. The inverse of an ' $n \times n$ ' matrix exists if and only if the rank is less than ' n '

(A) P and Q only

(B) P and R only

(C) Q and R only

(D) P and s Only

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Q118. The following set of three vectors $\begin{pmatrix}1\\2\\1\end{pmatrix}, \begin{pmatrix}x\\6\\x\end{pmatrix}$ and $\begin{pmatrix}3\\4\\2\end{pmatrix}$, is linearly dependent when x is equal to

(A) 0
(B) 1
(C) 2
(D) 3

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Q119. For the matrix $\begin{pmatrix} 4 & 3 \\ 3 & 4 \end{pmatrix}$ if $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ is an eigenvector, the corresponding eigenvalue is _____

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Q128. A set of simultaneous linear algebraic equations is represented in a matrix form as shown below

$$\begin{bmatrix} 0 & 0 & 0 & 4 & 13 \\ 2 & 5 & 5 & 2 & 10 \\ 0 & 0 & 2 & 5 & 3 \\ 0 & 0 & 0 & 4 & 5 \\ 2 & 3 & 2 & 1 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 46 \\ 161 \\ 61 \\ 30 \\ 81 \end{bmatrix}$$

The value (rounded off to the nearest integer) of x_3 is _____

Q144. For the matrix $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ if det stands for the determinant and A^T is the transpose of A then the value of $\det(A^T A)$ is _____