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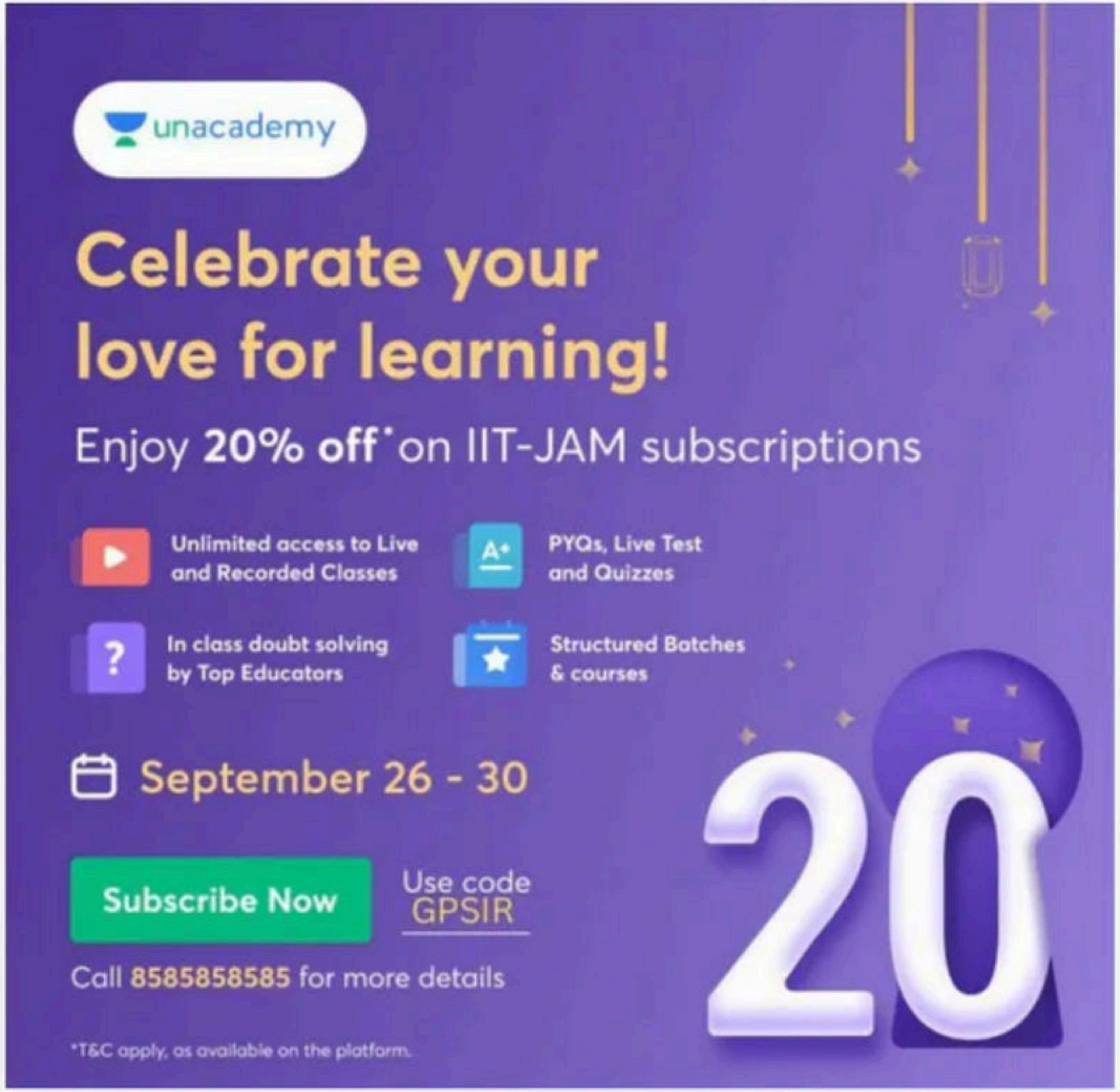
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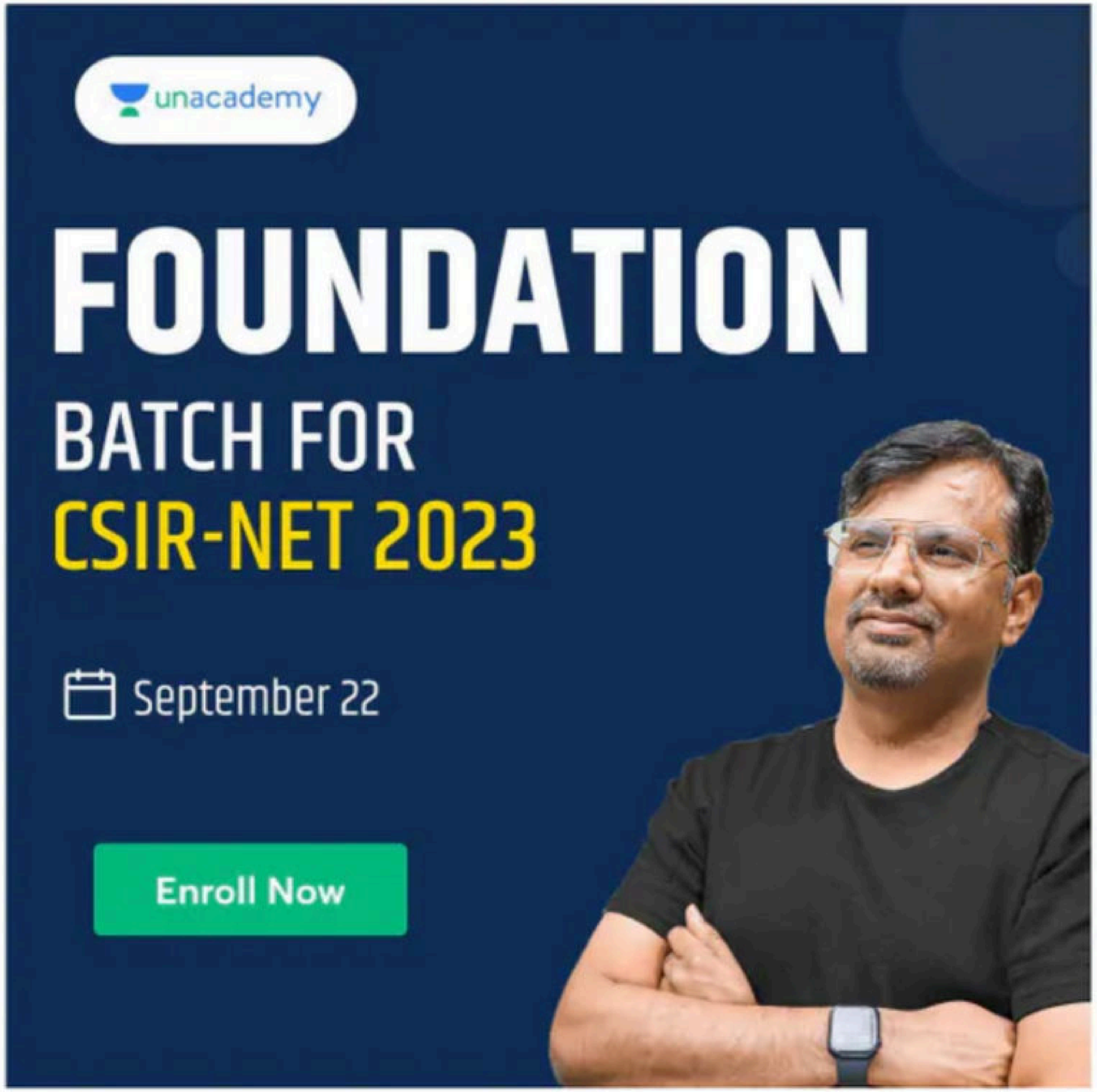
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One-One linear transformation : Let $T : V \to V'$ be a linear transformation with $\eta(T) = 0$ then T is called one-one linear transformation.

Onto linear transformation : Let $T : V \to V'$ be a linear transformation with $\rho(T) = \dim V'$ Then T is called onto linear transformation.

Singular and non-singular linear transformation :

A linear transformation $T : V \rightarrow V'$ is called singular linear transformation if $\eta(T) \geq 1$ and if $\eta(T) = 0$ then T will be non-singular.

Matrix representation : Let V(F) be an n-dimensional vector

space and V'(F) be an m-dimensional vector space over F.

Let $\beta_1 = \{x_1, x_2, ..., x_n\}$ & $\beta_2 = \{y_1, y_2, ..., y_m\}$ are ordered basis of V(F) & V'(F) respectively and T : V(F) → V'(F) be a linear transformation s.t.

$$
\begin{aligned}
T(x_1) &= a_{11}y_1 + a_{21}y_2 + ...a_{m1}y_m \\
T(x_2) &= a_{12}y_1 + a_{22}y_2 + ...a_{m2}y_m \\
&\vdots \\
T(x_n) &= a_{1n}y_1 + a_{2n}y_2 + ...a_{mn}y_m
\end{aligned}
$$

Then matrix representation of T relative to the ordered basis β_1 & β_2 is denoted by

$$
[T:\beta_1,\beta_2] = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{m1} & \cdots & \cdots & a_{mn} \end{bmatrix}_{m\times n}
$$

Q.2. Let $T : R^3 \to R^3$ be the linear transformation defined by $T(x, y, z) = (x + y, y + z, z + x)$ for all $(x, y, z) \in R^3$. Then

(a) rank (T) = 0, nullity (T) = 3

(b) rank(T) = 2, nullity (T) = 1

(c) rank(T) = 1, nullity (T) = 2

(d) rank (T) = 3, nullity (T) = 0

Q.3 Let $T : R^4 \to R^4$ be a linear map defined by $T(x, y, z, w) = (x + z, 2x + y + 3z, 2y + 2z, w)$. The rank of T is equal to

(a) 1 (b) 2

(c) 3 (d) 4

Q.4. Let N be the vector space of all real polynomial of degree atmost 3. Define $S : N \to N$ by $(S)p(x) = p(x + 1)$, $p \in N$. and the matrix of S in the basis $\{1, x, x^2, x^3\}$ considered as column vector then which of the following is true?

(a) S is upper triangular matrix with determinant 1.

(b) S is singular matrix

(c) S is upper triangular matrix with trace 1.

(d) S is identity matrix.

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Result :

(1) Let $T : M_2(R) \rightarrow M_2(R)$ be a linear transformation such that $T(X) = AX$, where A is given matrix. If A is diagonalizable then T is also diagonalizable.

(2) If $T : R^{m\times n} \rightarrow R^{n\times p}$ be a linear transformation such that $T(X) = AX$ then

(a) Rank (T) = n.Rank (A)

(b) Trace(T) = n.Trace(A)

(c) Nullity(T) = n.Nullity(A)

Q.5. Let A be a matrix of order n and let V be the vector space of all real $n \times n$ matrix X such that $AX = 0$. what is dimension of V. **CSIR NET JUNE 2022**

(a) nr (b) n^2r

(c) $n^2 - nr$ (d) n

Q.6 Let $M_2(R)$ denote the set of 2×2 real matrices. Let $A \in M_2(R)$ be a trace 2 and determinant -3. Identifying $M_2(R)$ with R^4, consider the linear transformation $T : M_2(R) \to M_2(R)$ defined by $T(B) = AB$. Then which of the following statements are true?

(a) T is diagonalizable

(b) 2 is an eigenvalues of T

(c) T is invertible

(d) $T(B) = B$ for some $0 \neq B$ is $M_2(R)$

Q.7 Let $T : R^4 \to R^4$ be the linear map satisfying $T(e_1) = e_2$, $T(e_2) = e_3$, $T(e_3) = 0$, $T(e_4) = e_3$ where $\{e_1, e_2, e_3, e_4\}$ is the standard basis of R^4. Then

(a) T is idempotent
(b) T is invertible
(c) Rank(T) = 3
(d) T is nilpotent

Q.8 Let $R^{2\times2}$ be the real vector space of all 2×2 real matrices for $Q=\begin{bmatrix}1 & -2\\ -2 & 4\end{bmatrix}$, define a linear transformation T on $R^{2\times2}$ as $T(P)=QP$. Then the rank of T is

(a) 1 (b) 2

(c) 3 (d) 4


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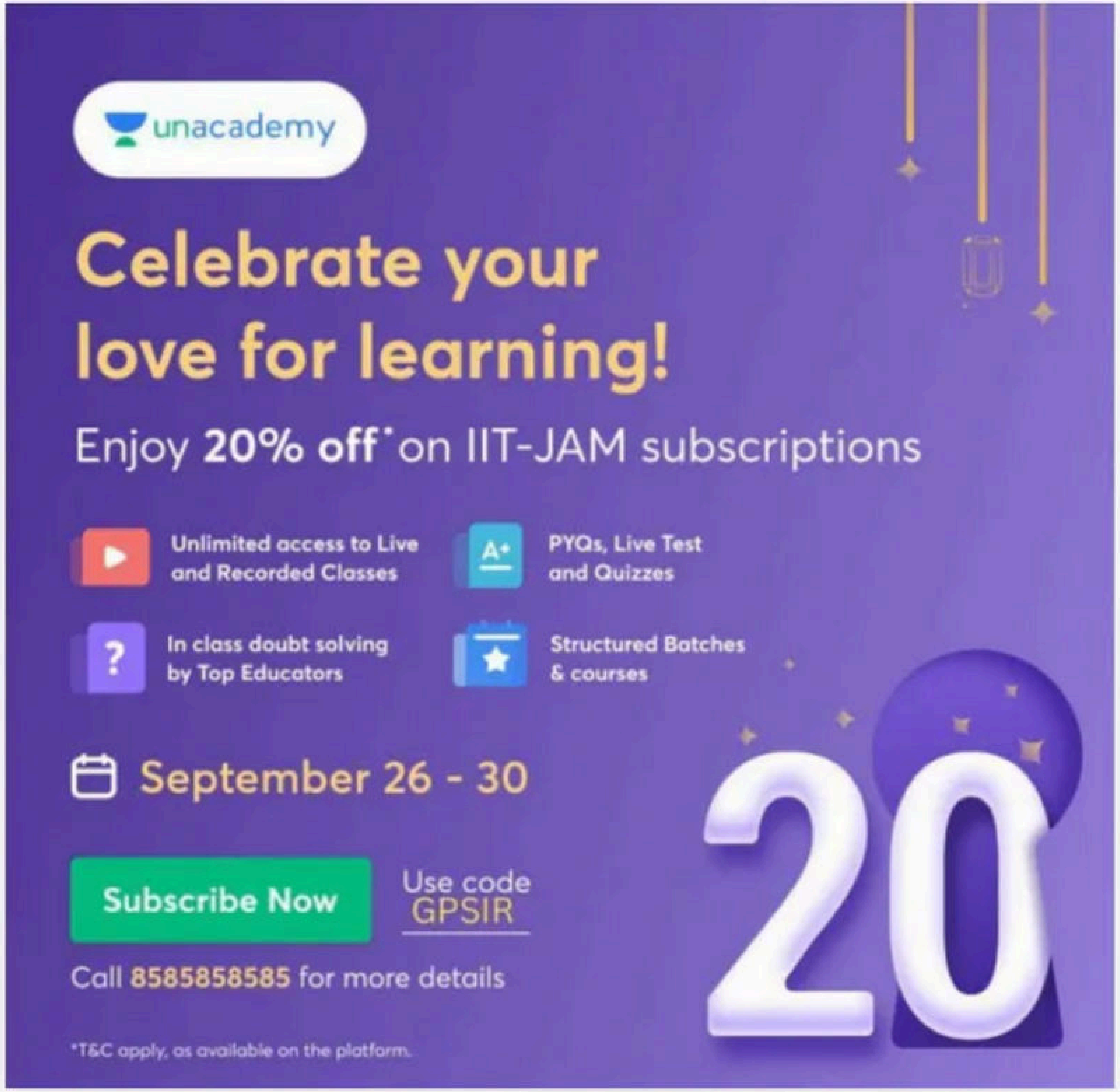
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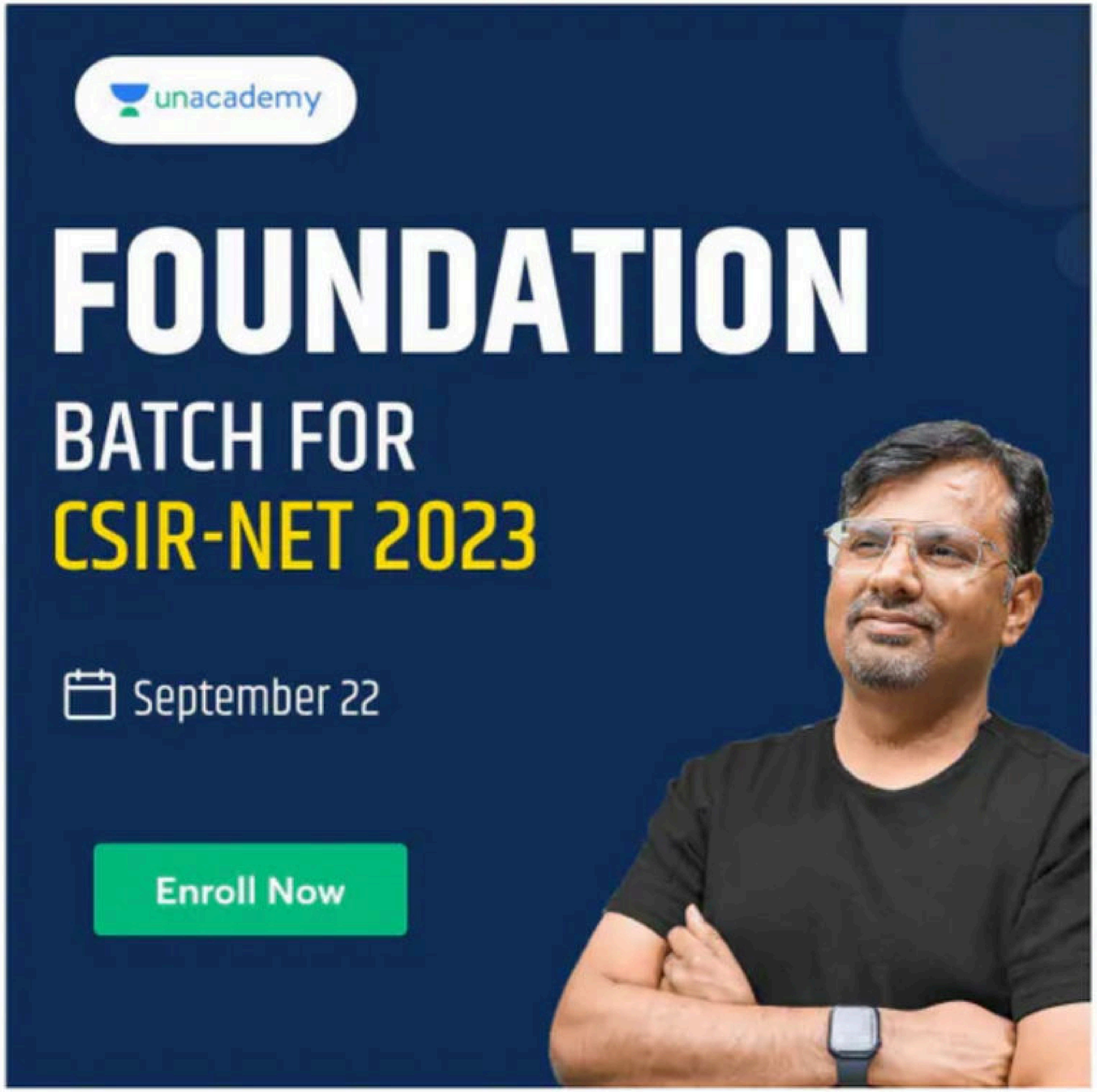
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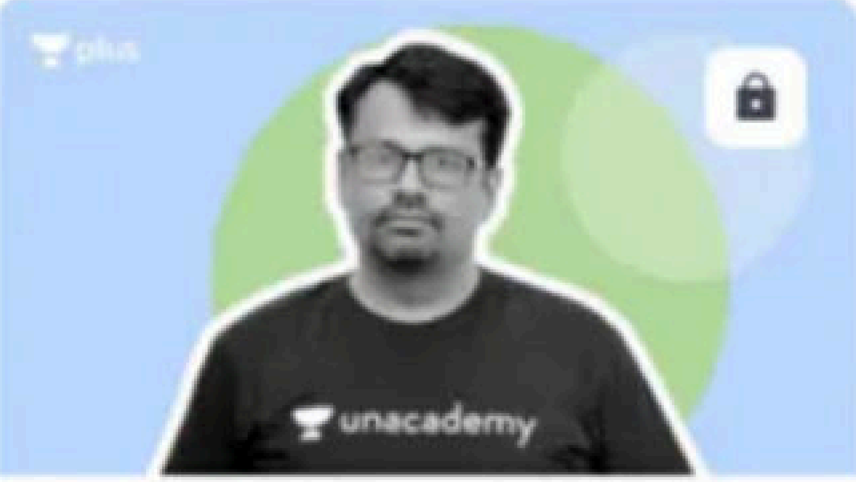

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- Works at **Pacific Science College**
- Studied at **M.Sc., NET, PhD(Algebra), MBA(Finance), BEd**
- PhD, NET | Plus Educator For CSIR NET | Youtuber (260K+Subs.) | Director Pacific Science College |
- Lives in **Udaipur, Rajasthan, India**
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