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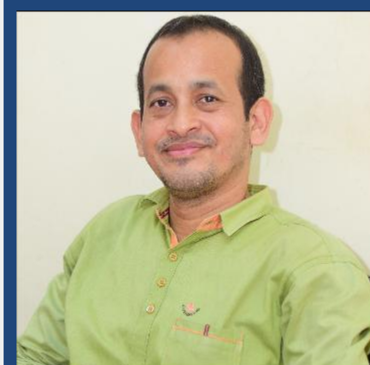
MESSAGE FROM THE DESK OF EDITOR IN CHIEF

The Chief Editor and Editors of the advanced research journal of Management, Engineering, Law, Paramedical Science, Nursing, Basic Science, Education, Physical Education and Yoga, Special Education, Clinical psychology and Liberal Arts i.e. IUT Journal of Advanced Research and Development (JARD) would take it as their duty to express the deep gratefulness to the contributors and readers of current volume.

We feel proud to bring the present issue of the online IUT Journal of Advanced Research and Development. We consider that the contribution in this multidisciplinary will help in the inclusive and sustainable growth process. Keeping in tune with this dignified idea, the current issue of IUT-JARD has addressed some current issues covering diversified field.

This issue needs an integrative and a holistic approach to the solution. Finally, the information contains in this journal volume has been published by the IUT obtains by its authors from various sources believed to be reliable and correct to the best of their knowledge, and publisher is not responsible for any kind of plagiarism and opinion related issues.



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IMPLEMENTING THE STANDARD CHAPLYGIN GAS EQUATION IN EXPLORING THE ASSORTED SUBSISTENCE OF DARK ENERGY IN RELATIVISTIC COSMOLOGY

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ABSTRACT

In Astrophysics and Cosmology, dark energy has been acknowledgedas the hypothetical form of energy, exhibiting the property of negatively aggrandized pressure which in turn defeats gravity and has been extremely responsible for the accelerated expansion acclimatized in the cosmos. This present study deals with the formulation of a cosmic model with the persistence of spatially flat Friedmann Robertson Walker (FRW) Metric where the sustenance of the Equation of State of the Barotropic Fluid is perfectly operational under the sturdy appearance of the Standard Chaplygin Gas Equation. Some of the physical parameters associated with this cosmic model such as the pressure, energy density, Hubble Constant, scale factor of the cosmos etc., have been investigated in the light of Standard Chaplygin Gas Equation.

Keywords: Accelerated Expansion, Anisotropy, Cosmos, Dark Energy, Hubble Constant.

1.0 Introduction:

The cosmic model formulated for this current study portrays the connotation that the scalar expansion θ endures developments with signified points of spacetime. The energy density ρ of the model universe under presumption sketches a vivid scenario depicting the early epoch cosmos and the late eon cosmos which has been grounded on the characteristic behaviour when $a \leq 1$ that entails $\rho \sim K^2 {a_0}^2 a^{-2}$ whereas in the case of late epoch universe, satisfying $a \geq 1$, we shall arrive at $\rho \sim (-\omega_0)^{\frac{1}{2}}$

Such interpretations essentially redirect to a cosmic scenario of the very early epoch of the cosmos where the energy density ρ conforms to a condition which is $\rho \sim a^{-2}$. This erects analogous to the mysterious non-relativistic matter component abundant in the cosmos which is more commonly intelligible as the dark matter.

The other cosmic scenario relating to the late epoch cosmos implicates that the energy density ρ behaves as $\rho \longrightarrow (-\omega_0)^{\frac{1}{2}}$ which essentially furnish that such a cosmic ambiance necessitates the predominance of dark energy in the cosmos. From these two different constraint conditions essentially signifies that the fusion of Standard Chaplygin gas model in a Barotropic fluid is sufficient to explicate the genesis of dark energy and at the same instance the dark matter collectively.

Such asymptotic characteristic flourished by the physical property of the universe which is the energy density ρ in this context isprecisely functional while inculcating the Standard Equation of Chaplygin Gas with the Barotropic fluid content of the model universe under presumption. Earlier this entire cosmic scenario has been envisioned by Pallavi Saikia [1] and the allied physical properties concerning to the model universe viz., the pressure, scale factor, Hubble Constant, Anisotropic behaviour have been deliberately investigated.

1.1 Introducing the Standard Equation of Chaplygin Gas:

In Astrophysics and Space Science, the portrayal of Chaplygin gas stands for a hypothetical substance that satisfies an exotic equation of state in the form

$$p = -\frac{A}{\rho^{\alpha}}$$

where the symbols have their usual meanings i.e., p is the pressure, ρ is the energy density. and A is positive constant and $\alpha = 1$

The Equation of state for the Standard Chaplygin Gas can be expressed as:

$$p = -\frac{A}{\rho}$$

This very equation has its utilization in cosmological arena toformulate a mathematical cosmic model which emerges as an effective model inamalgamating a dark energy and dark matter engrained cosmological ambiance.

2. Developing the Mathematically Engrained CosmicModel:

This present study deals with a cosmological model that has been show grounded on an explicitly flat Friedmann-Robertson-Walker (FRW) Model. This model envisaged the implication of the metric which can be most generously represented as follows:

$$ds^2 = dt^2 - a^2 t\,[dr^2 + r^2 d\theta^2 + r^2 sin^2\,\theta\,d\phi^2] \;...\;(1)$$

The energy momentum tensor has the representation as under:

$$T_{\mu\nu} = e\,u_i u_j + p\left(u_i u_j - g_{ij}\right) \;.................................(2)$$

The terms appearing in Equation (2), exhibits their respective meanings as
ρstands for the energy density of the cosmic fluid
$p$denotes the pressure of the fluid

$u_i$stands for the four-flow vector substantializing the relation

$$g_{ij}u^i u^j = 1 \text{ ....(3)}$$

Representing Einstein's Field Equations as:

$$R_{ij} - \frac{1}{2}g_{ij}R = -8\pi G\left[\rho u_i u_j + p\left(u_i u_j - g_{ij}\right)\right] \text{.........(4)}$$

Equation (4) effectively producesthe following two subsequent Equations as:

$$8\pi G\rho = -2\frac{\ddot{a}}{a} - \frac{\dot{a}^2}{a^2} \text{ ....(5)}$$

and

$$8\pi G\rho = -3\frac{\dot{a}^2}{a^2} \text{ .... (6)}$$

As mentioned earlier in the Section 1.1, The Equation of state for the StandardChaplygin Gas is:

$$p = -\frac{A}{\rho} \text{....................(7)}$$

In this above Equation (7),Astands for a positive constant i.e., $A > 0$. The other physical parameters appearing here is the pressure$p$ and the energy densityρ. Mathematical computations justify that the correlation between the pressure and energy density under such a cosmic ambiance has been governed by an inversely proportional correspondence between these two physical parameters of the cosmos.

The Equation of state for the Barotropic Fluid can be expressed as follows:

$$p = \rho\omega \qquad \text{...............................(8)}$$

Equation (8) precisely gets validated with the Equation of State (EoS) or dimensionless parameter ωthat conforms to the inequality constraint$\omega < -1$
Here we shall implementthe value of p from Equation (8) and substituting in Equation (7) for which we find the value of the constant Aas

$$-\frac{A}{\rho} = \rho\omega \Longrightarrow A = -\omega_p\rho_p^2 \qquad \text{.......................(9)}$$

Here in this above Equation (9) and proceeding further, we shall use the suffix p(wherever applicable) in order to indicate the present values exhibited by the physical parameters involved in formulating the cosmic model relating to the model universe.

Expressing the Equation of Energy Momentum as under

$$\dot{\rho} + 3\left(\frac{\dot{a}}{a}\right)(p + \rho) = 0$$

From this above Equation, on computing the first order derivative of ρ, we get

$$\dot{\rho} = -3\left(\frac{\dot{a}}{a}\right)(p + \rho)$$

…………………………….(10)

Now, we shall apply the Standard Chaplygin Gas Equation from Equation (7) and substituted in Equation (10) which leads to the following equation as

$$\dot{\rho} = -3\left(\frac{\dot{a}}{a}\right)\left[-\frac{A}{\rho} + \rho\right]$$

$$\Rightarrow \frac{1}{2}\log|\rho^2 - A| = -3\ \log a + \log K$$

Here $\log K$ is the integration constant to be added

$$\Rightarrow \rho^2 - A = K^2.\left[\frac{a_p}{a(t)}\right]^2$$

[Writing, $a^{-3} = \left[\frac{a_p}{a(t)}\right]$]

$$\Rightarrow \rho = \left[A + K^2.\left[\frac{a_p}{a(t)}\right]^2\right]^{\frac{1}{2}}$$

……...……………………(11)

where ρ_p stands for the current value of the energy density ρ and
a_p is denoting the value of the scale factor $a(t)$ at the present time instant t_p

Equation (9) illustrates the relationship between the Equation of State parameter ω and the positive constant A as

$$\omega = \frac{p}{\rho}$$

$$\Rightarrow \omega_p = -\frac{A}{\rho_p^2}$$

………………………………...(12)

Now, we present the current value of the EoS parameter involved in the equation as $\omega_p = \omega(t_p)$, t_p denotes the present time instant.

The expression for pressure $p$as obtained from Equation (7) can be represented as

$$p = \frac{\omega_p \rho_p^2}{\rho} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

Utilizing Equations (9) and (11), we can present the energy density ρ as

$$\rho = \left[-\omega_p \rho_p^2 + K^2 . \left[\frac{a_p}{a(t)}\right]^2\right]^{\frac{1}{2}}$$

……... ... ………………………(14)

There have been two propositioned forms of dark energy viz., the Cosmological Constant, usually denoted by the Greek letter Λ and introduced by the greatest physicist of modern epoch, Albert Einstein for sketching the perception of a statis cosmos and the second one essentially illustrating the Scalar Fields, those considered as dynamical quantities, possessing energy densities that get alterations with time and space, for instance the Quintessence, depicting the cosmological scenario of a hurriedly streaming out cosmos in every permissible direction.

This Quintessence model of the cosmos for this present study have been represented with the assistance of the Equations [1] and [2] which stands for a perfectly scalar field model and might arouse the predilection of articulating with the insinuation of a field ϕ and a $V(\phi)$ potential.

Under such a slant, the vivid physical parameter ρ for this cosmic ambiance is represented byρ_Q and the pressure by$P_Q$becoming apparent from the Quintessence Scalar Field Model, signified by the Equations as under

$$\rho_Q = \frac{1}{2}\dot{\phi}^2 + V(\phi)$$

and

$$p_Q = \frac{1}{2}\dot{\phi}^2 - V(\phi)$$

Presuming the endurance of the model universe pertaining the characteristic behaviours of a homogeneous and isotropic cosmos, these aforementioned Equations take the representation as:

$$\rho_\phi = \frac{1}{2}\dot{\phi}^2 + V(\phi) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(15)$$

and

$$p_\phi = \frac{1}{2}\dot{\phi}^2 - V(\phi) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(16)$$

Here $V(\phi)$ stands for the potential of the scalar field $\phi(t)$considered w.r.t. time instant$t$.
Applying Equations (7) and (9), we have from Equation (16) as

$$\frac{\dot{\phi}^2}{2} = \frac{\omega_p \rho_p^2}{\rho} + V(\phi)\text{.........................}(17)$$

[Writing $p_\phi = p$ and implementing Equation (13) here]

Equation (15) builds

$$\frac{\dot{\phi}^2}{2} = \rho - V(\phi)\text{...........................}(18)$$

[Writing $\rho_\phi = \rho$]

Equations (17) and (18) are added, so we get the first order derivative of the scalar field ϕ

$$\dot{\phi}^2 = \frac{\omega_p \rho_p^2 + \rho^2}{\rho}$$

............................(19)

At this step, we use the Equations (14) and (19) so that we shall get

$$\dot{\phi}^2 = \frac{K^2.\left[\frac{a_p}{a(t)}\right]^2}{\left[K^2.\left[\frac{a_p}{a(t)}\right]^2 - -\omega_p \rho_p^2\right]^{\frac{1}{2}}}$$

.............................(20)

It has been quite predictive that for a set of values for $\omega_p > -1$, we shall attaina cosmic ambiance which suggests the inequality condition$\dot{\phi}^2 > 0$that springs to a state of attaining positive kinetic energy characterizing that under such cosmological circumstances, the appearance of dark energy might arise in the form of Quintessence. Furthermore, with the constraint inequality $\omega_p < -1$, conforming the condition $\dot{\phi}^2 < 0$ subsists negatively aggrandized dark energy in the cosmos, strictly directing to the Phantom form of dark energy. Thus, the formulated cosmic model for this present paper endorsed three diversified

emergences of dark energy in the cosmos which are as: the Standard Chaplygin Gas, Quintessence and dark energy itself.

The Einstein Friedmann Equation while analyzed in this context of the form of dark energy results the following Equation as

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G_N}{3}.\rho$$

$$\Rightarrow \left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G_N}{3}.\left[K^2.\left[\frac{a_p}{a(t)}\right]^2 - \omega_p \rho_p^2\right]^{\frac{1}{2}}$$

[Utilizing Equation (14)]

…………………………………(21)

where the denotation G_N represents the Newtonian Gravitational Constant.

In this above Equation (21) the energy density ρ_p at current time instant $(t = t_p)$ prefers the following relation

$$\rho_p = \Omega_p \rho_p^{(c)} \quad \text{………………………………………(22)}$$

Applying the above Equation (22), Equation (21) gives rise to,

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G_N}{3} \cdot \left[K^2 . \left[\frac{a_p}{a(t)}\right]^2 - \omega_p\left(\Omega_p \rho_p^{(c)}\right)^2\right]^{\frac{1}{2}} \text{……………………(23)}$$

$$\Rightarrow \left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G_N \rho_p^{(c)}}{3} . \ \Omega_p \left[K^2 . \left[\frac{a_p}{a(t)}\right]^2 - \omega_p\right]^{\frac{1}{2}} \text{………………………...(24)}$$

Equation (24) provides the present value of the Hubble Constant $H_p(t = t_p)$ which can be computed by applying the formula,

$$H_p^2 = \frac{8\pi G_N \rho_p^{(c)}}{3} \text{…………………………...…(25)}$$

Thus, Equation (24) yields,

$$\frac{\dot{a}}{a} = H_p . \sqrt{\Omega_p} . \sqrt{\omega_p} . \sqrt{\left(\frac{1}{\omega_p} . K^2 . \left[\frac{a_p}{a(t)}\right]^2\right) - 1}$$

……………………………..(26)

This situation demands the cosmic circumstances as follows,

$$|\omega_p| > 1 \text{ and } \rho_p^{(c)} = \frac{3H_p^2}{8\pi G_N} \text{ ………………………… (27)}$$

$$\frac{\dot{a}(t)}{a(t)} \simeq H_p . \sqrt{\Omega_p} \left[\left(K^2 . \left[\frac{a_p}{a(t)}\right]^2\right) + |\omega_p|\right]^{\frac{1}{2}}$$

Now expanding the R.H.S. of the Equation (26) up to the second order terms and neglecting the third and other higher order terms, we shall have

$$\frac{\dot{a}(t)}{a(t)} \simeq H_p . \sqrt{\Omega_p} |\omega_p|^{\frac{1}{2}} \left[1 + \frac{1}{2} . K^2 . \frac{1}{|\omega_p|} . \left[\frac{a_p}{a(t)}\right]^2\right]$$

Thereby Integrating,

$$a(t)^2 = 2 H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} \left[1 + \frac{1}{2} . K^2 . \frac{{a_p}^2}{|\omega_p|}\right] (t - t_p) + K_2$$

whereK_2istheconstant of integration to be added

……………………………………….. (28)

$$\Rightarrow \left[\frac{a(t)}{a_p}\right]^2 = 2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\left(t-t_p\right)$$

Neglecting K_2at this step for the sake of mathematical conveniences

……………………………………….. (29)

From Equation (28), we have

$$a(t) = \left[2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}\left[1+\frac{1}{2}.K^2.\frac{{a_p}^2}{\left|\omega_p\right|}\right]\left(t-t_p\right) + K_2\right]^{\frac{1}{2}}$$

$$\Rightarrow \frac{a(t)}{a_p} = \left[2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\left(t-t_p\right)\right]^{\frac{1}{2}}$$

……………………………….(30)

$$\Rightarrow \frac{a_p}{a(t)} = \left[2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\left(t-t_p\right)\right]^{-\frac{1}{2}}$$

………………………………..(31)

Now, substituting the value of $\frac{a_p}{a(t)}$ from Equation (31) in Equation (14), we shall get the modified value of the energy density ρ as

$$\rho = \left[-\omega_p\rho_p^2 + K^2.\left[\frac{a_p}{a(t)}\right]^2\right]^{\frac{1}{2}} \text{[Equation (14)]}$$

$$\Rightarrow \rho = \left[-\omega_p\rho_p^2 + K^2.\frac{1}{2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}+\frac{1}{4}.\frac{K^4}{\left|\omega_p\right|^2}+\frac{1}{8}.\frac{K^6}{\left|\omega_p\right|^3}+\cdots\dots\dots+\cdots\infty\right]\right]^{\frac{1}{2}}$$

Implementing the Binomial Expansion of $\left[1-\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]^{-1}$, considering up to second terms and neglecting all higher order terms, we shall have the expression for the energy density ρ as

$$\rho = \left[\frac{K^2}{2\,H_p.\,\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right] - \omega_p\rho_p^2\right]^{\frac{1}{2}}$$

…………………………………………….(32)

Now applying the Equations (7) and (9), we have the expression for pressure p as

$$p = \frac{\omega_p \rho_p^2}{\rho}$$

$$\Rightarrow p = \omega_p \rho_p^2 . \left[\frac{K^2}{2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)} \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|} \right] - \omega_p \rho_p^2 \right]^{-\frac{1}{2}}$$ [Applying Equation (32)]

……………………………………….(33)

Volume Vcan be represented by the following relation

$$V = a(t)^3$$

In Cosmology and Space Science, the scale factor $a(t)$ depicts a dimensionless magnitude that indicates the comparative size of the cosmos at a particular instant of time when compared to is size at a point of substantiation, usually considered w.r.t. this present day that fundamentally
clarifies the extent regarding how considerably the cosmos has experience magnification from a specified time instant in the extreme earlier epoch as when the cosmos undergoes a rapid exponential expansion just after the Big Bang cosmology i.e., the inflation and the scale factor of the cosmos starts developing thereafter.

Therefore, calculating the volume of the cosmos, we shall have the following expression for V

$$V = \left[2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} \left[1 + \frac{1}{2} . K^2 . \frac{{a_p}^2}{|\omega_p|} \right] (t - t_p) + K_2 \right]^{\frac{3}{2}}$$

…………………………………..(34)

[Implementing Equation (28)]

Equation (25) give rise to the expression indicating the present value of the Hubble Constant $H_P$as

$$H_p^2 = \frac{8\pi G_N \rho_p^{(c)}}{3}$$

Utilizing the present value of ρ at the current time instant, denoted by $\rho_p^{(c)}$ in Equation (25), we get

$$H_p = \left(\frac{8\pi G_N}{3} \right)^{\frac{1}{2}} . \left[\frac{K^2}{2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)} . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|} \right] \right]^{\frac{1}{2}} .$$

$$\left[1 - \omega_p \rho_p^2 . \left[\frac{2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)}{K^2 . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|} \right]} \right] \right]^{\frac{1}{2}}$$

…………………………………..(35)

Now considering the term

$$\left[1-\omega_p\rho_p^2.\left[\frac{2\,H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]^{\frac{1}{2}}$$

we apply Binomial Expansion and neglecting third and all higher order terms, we shall arrive at

$$\left[1-\omega_p\rho_p^2.\left[\frac{2\,H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]^{\frac{1}{2}}=1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]$$
………………………..(36)

Therefore, implementing Equation (36) in Equation (35), we have the expression for present value of the Hubble Constant as

$$H_p=\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right]^{\frac{1}{2}}.\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]$$
…………………………(37)

The Equation rendering to Shear stress,

$$\sigma=0$$ …………………………(38)

Anisotropy parameter concerning to the model universe,

$\Delta=0$ …………………………(39)

We have at this moment,

$$H_x=H_y=H_z=\frac{\theta}{3}$$

$$=\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right]^{\frac{1}{2}}.\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}\,.\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]$$
……………………………..(40)

Also,

$$\theta=\frac{\dot{V}}{V}=3\frac{\dot{a}}{a}$$

Therefore,

$$\theta = 3.\frac{\theta}{3}$$

$$= 3.\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}}.\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]\right]$$

……………………………..(41)

[Using Equation (40)]

The deceleration parameter $q$have the expression as

$$q = -1 - \dot{H}H^2 \qquad \text{………………………………..(42)}$$

Equation (40) provides us the computed value of the Hubble Constant$H$as

$$H = \left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}}.\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]\right]$$

Now calculating the first order derivative, $\dot{H} = \frac{dH}{dt}$ we have the value as

$$\dot{H} = -\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}}.\omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]$$

………………………………..(43)

Also,

$$H = \left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}}.$$

$$\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]$$

$$\therefore H^2=\frac{8\pi G_N}{3}.\left[\frac{K^2}{2\,H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right].\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]^2$$

……………………………..(44)

Therefore, computing the expression $\dot{H}H^2$, we have

$$\dot{H}H^2=-\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right]^{\frac{1}{2}}.\omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right].$$

$$\left[\frac{8\pi G_N}{3}.\left[\frac{K^2}{2\,H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right].\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]\right]^2\right]$$

[Substituting the values from Equations (43) and (44)]

$$\Rightarrow \dot{H}H^2=-\left(\frac{8\pi G_N}{3}\right)^{\frac{3}{2}}.\left[\frac{K^2}{2\,H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right]^{\frac{3}{2}}.$$

$$\omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right].\left[1-\ 2\omega_p\rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]+\omega_p{}^2\rho_p^4.\left[\frac{H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}.\left(t-t_p\right)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]}\right]^2\right]$$

……………………………..(45)

Substituting the value of $\dot{H}H^2$ from Equation (45) in Equation (42), we get

$$q=\left(\frac{8\pi G_N}{3}\right)^{\frac{3}{2}}.\left[\frac{K^2}{2\,H_p.\ \sqrt{\Omega_p}\ .\left|\omega_p\right|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{\left|\omega_p\right|}\right]\right]^{\frac{3}{2}}.$$

$$\omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right].\left[1-\ 2\omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]+\omega_p{}^2\rho_p^4.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]^2\right]-1$$

…………………………….(46)

3.1 Analysis Portrayed on the Energy Density ρ:

From Equation (32), we get the expression for the energy density ρwhich is as under

$$\rho=\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]-\omega_p\rho_p^2\right]^{\frac{1}{2}}$$

As time progresses i.e. when $t\longrightarrow\infty$, we have $\rho\longrightarrow 0$. This cosmic ambiance emphasizes the persistence of dark energy in the cosmos and subsequently the enunciation and dominance of a dark energy dominance eon redirecting to an accelerated intensification of the cosmos in a fast-track podium.

3.2 Investigation Carried Out on the Friedmann Robertson Scale Factor $a(t)$:

From Equation (28), the scale factor $a(t)$is expressible as

$$a(t)=\left[2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}\left[1+\frac{1}{2}.K^2.\frac{a_p{}^2}{|\omega_p|}\right](t-t_p)+\ K_2\right]^{\frac{1}{2}}$$

With the advancement of time epochs i.e., as $t\longrightarrow\infty$, the scale factor $a(t)\longrightarrow\ \infty$. In Cosmology and Space Science, the scale factor denotes a dimensionless quantity that suggestivelyindicates the enlargement of the cosmos. As soon as the scale factor $a(t)$tends to an infinite value, the précised cosmic set-up acclimatizes a scenario where the cosmos approaches to accomplish an infinitely escalated measure.

3.3 Analysis Performed on Hubble Constant:

From Equation (40), the Hubble Constant is expressible as

$$H=\left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}}.\left[\frac{K^2}{2\,H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}}.\left[1-\ \omega_p\rho_p^2.\left[\frac{H_p.\sqrt{\Omega_p}.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]\right]$$

With the advancement of time factor i.e., as $t\longrightarrow\infty$, the Hubble Constant or more precisely the Hubble Parameter under such scenario, verges upon tending to a constant numerical value asymptotically, as ascertained by Einstein's Cosmological Constant Λ. This essentially explicates the dominance of dark energy in modern epoch, abided by the Equation $H = \sqrt{\Lambda \frac{c^2}{3}}$, that mathematically signifies that the prolonged- time streaming out mechanism in every possible direction conforms to exponential expansion and eventually the Hubble Parameter decelerates from its present value to a constant numerical entity but does not practically attain the value zero or infinity. This constant value redirects to a de-Sitter type universe in which the exponential streaming out directly triggers out to the size of the cosmos that gets double of its size in a finite time span.

However, as $t \longrightarrow \infty$, $H \longrightarrow 0$. This is the moment when the cosmos stops expanding, eventually indicating null movements between cosmological objects. However, such an ambiance is realistically unfeasible in relevance to dark energy's dominance in modern time epoch. Although Astrophysics and Cosmology can grant for a cosmic back drop where the utmost significant physical parameter i.e., the Hubble Constant can suffer hindering or reduced speed mechanism to some extent but sensibly cannot accomplish a value equal to zero.

3.4 Investigation Portrayed on q, the Deceleration Parameter of the Cosmos:

From Equation (46), we have

$$q = \left(\frac{8\pi G_N}{3}\right)^{\frac{3}{2}} . \left[\frac{K^2}{2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}}} . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]\right]^{\frac{3}{2}} .$$

$$. \, \omega_p \rho_p^2 . \left[\frac{H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}}}{K^2 . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]}\right] . \left[1 - \; 2\omega_p \rho_p^2 . \left[\frac{H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)}{K^2 . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]}\right] + {\omega_p}^2 \rho_p^4 . \left[\frac{H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)}{K^2 . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]}\right]^2\right] - 1$$

For $t - \; t_p \gg 0$, q gets diminishing and sometimes even achieve negatively developed values i.e., $q < 0$ and the converse grows as the $(t - \; t_p) \longrightarrow 0$, $q$growsamplified.

In Astrophysics, such measure suggestively empowering the cosmic scenario which establishes the rate experienced by the cosmos when a positively motivated value of the decelerating parameter directs to the decelerating state incurred in the cosmos and conversely a negatively précised value of the parameter triggers to an accelerated streaming apart of the cosmos in every admissible direction.

3.5 Inspection Carried Out on Volume:

From equation (34), we shall get the volume V as

$$V = \left[2\, H_p.\ \sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}\left[1+\frac{1}{2}.K^2.\frac{{a_p}^2}{|\omega_p|}\right](t-t_p) + K_3\right]^{\frac{3}{2}}$$

As time proceeds i.e., $t \to \infty$, volume V of the cosmos suffers intensification.

3.6 Investigation Sketched on the Grounds of Pressure:

Equation (33) provides the following expression for pressure p which is

$$p = \omega_p \rho_p^2.\left[\frac{K^2}{2\, H_p.\ \sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}.(t-t_p)}\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right] - \omega_p \rho_p^2\right]^{-\frac{1}{2}}$$

Inspecting the above cosmic scenario and supposition of implementing the said ambiance in the far future, i.e., as $t \to \infty$, Equation (36) implies that $p \ll 0$. In Astrophysics and particularly in Cosmology, a negatively epitomized pressure enriched scenario redirecting the ascendency of dark energy in the cosmos, efficaciously deploying a repulsive gravitational force of attraction which has been extremely responsible for the exponential expansion incurred in the cosmos.

3.7 Exploration Centralized on Critical Density $\rho_c$in the Pursuance of Energy Density:

The critical density ρ_c of the cosmos have its most explicated Equation in connection to the energy density ρ of the cosmos by the following

$$\rho_c = \frac{3H^2}{8\pi G}$$

Thus,

$$\rho_c = \frac{G_N}{G}.\left[\frac{K^2}{2\, H_p.\ \sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}}.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]\right].\left[1 - \ \omega_p \rho_p^2.\left[\frac{H_p.\ \sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}.(t-t_p)}{K^2.\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right]}\right]\right]^2$$

[Applying Equation (37)]

The above Equation predicts that the energy density $\rho \longrightarrow \left[1+\frac{1}{\omega_0}\right]$approaches to a constant value, essentially signifying that it sturdily portrays the configure of dark energy's subsistence. The density parameter Ω of the cosmos has been defined as the ratio of the genuine or observed density ρ to the critical density ρ_c in relation to the Friedmann universe in Relativistic Cosmology.

4.0The Extracted Conclusion:

The model universe considered for this present study emphasizes the physical parameters of the cosmos, for instance the scale factor $a(t)$ and the volume V escalates with time. Following the dominance of dark energy in today's eon, the Anisotropy Parameter of expansion is professed to be zero envisaging that the cosmos has been basically isotropic in its disposition.

In Cosmology, the anisotropy of the cosmos is characteristically expressed by the following

$$A = \frac{1}{3} . \sum_{i=x}^{z} \frac{(H_i - H)^2}{H^2}$$

………………………………….(47)

In equation (40),

$H_i \; ; i = x, y, z$denotes the value of the Hubble Parameter in each of the three principal directions $x = y = z$

Equation (47) gives rise to

$$A = \frac{1}{3}\left[\frac{(H_x - H)^2}{H^2} + \frac{(H_y - H)^2}{H^2} + \frac{(H_z - H)^2}{H^2}\right]$$

As it has been quite discernable that

$$H_x = H_y = H_z = \frac{\theta}{3}$$

$$= \left(\frac{8\pi G_N}{3}\right)^{\frac{1}{2}} . \left[\frac{K^2}{2\, H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}}} . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]\right]^{\frac{1}{2}} . \left[1 - \omega_p \rho_p^2 . \left[\frac{H_p . \sqrt{\Omega_p} . |\omega_p|^{\frac{1}{2}} . (t - t_p)}{K^2 . \left[1 + \frac{1}{2} . \frac{K^2}{|\omega_p|}\right]}\right]\right]$$

[Equation (40)]

Thus, we have

$$A = 0$$

The above Equation presents anisotropy in the cosmos, necessarily appraises the comparative distinction in the expansion rate in varied directions signifies the anisotropy slant of the cosmos, predominantly acclimatizing the cosmological back drop of a reasonably homogeneous and isotropic featured cosmos.

From Equation (33), the characteristic property flourished by the physical parameter p assures that pressure conforms to negatively magnified values for which we acquire the inequality condition

$p \ll 0$ with the advancement of time scale and whenever the difference between any particular time instance $t$and a present time instant $t_p$becomes significantly negligible and develops only negatively enhanced quantities, in that cosmic domain, pressure obsesses only negative values and a negative pressure in Cosmology demands a cosmological set-up which necessitates the governance of dark energy in the discernible cosmos.

For this present study, the values of the directional Hubble parameter, Anisotropy parameter and shear tensor, all have been persevered to be a zero value. At this instance, it should be proficiently professed that the equation of state has been precisely consistent with accomplishing negatively prioritized values, associated with a deteriorating function of time instances. Such progressions entail that the cosmos starts with the structure that chiefly comprehended dark energy in the manifestation of Chaplygin gas subsequently the dark energy enchanting the configuration of Quintessence and emphatically the present mathematical model under supposition energetically emerge out to be a cosmos stuffed with dark energy in the appearance of Phantom energy as established in [3,4].

From Equation (28), the scale factor $a(t)$at time t_s is expressed as follows:

$$a(t) = \left[2\,H_p.\sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}\left[1+\frac{1}{2}.K^2.\frac{{a_p}^2}{|\omega_p|}\right](t-t_p)+\,K_2\right]^{\frac{1}{2}}$$

Equation (30) implies

$$\frac{a(t)}{a_p} = \left[2\,H_p.\sqrt{\Omega_p}\,.|\omega_p|^{\frac{1}{2}}\left[1+\frac{1}{2}.\frac{K^2}{|\omega_p|}\right](t-t_p)+\,K_2\right]^{\frac{1}{2}}$$

[Simplifying by considering the constant K_2 at this step]

From this Equation, we shall arrive at the time instance t_s as under

$$2\,H_p.\sqrt{\Omega_0}\,.|\omega_0|^{\frac{1}{2}}\left[1+\frac{1}{2}.\frac{K^2}{|\omega_0|}\right](t-t_0) = -K_2{}^{\frac{1}{2}}$$

This endorses the likelihood of emergence of cosmic bounce or singularity which justifiably redirects to a theoretical set-up such that the cosmos encompassed compactification or in a simpler sense contraction to a exceedingly denser state and in this process, experiences bouncing back mechanism into an expansion state which gets repeated in a cyclic process of contraction and expansion while a singularity fundamentally designates a point structure in spacetime where density and curvature tend to become infinite. This nature of bouncing phenomenon mostly envisaged with a stimulus shifting tendency from one nature of dark energy to another nature. At diversified time epochs, the sturdy endurance of an accelerated streaming apart of the cosmos since the scale factor $a(t)$approaches infinity as time proceeds on and definitively $t \longrightarrow \infty$. The scalar expansion θ for this current investigation has been established to be a hurried intensification of the cosmos.

Conversely, the pressure and density for this model universe have been developed to restrain only finite values with the progress of time instances which essentially approaches to meet an infinite value. Thus, the anisotropy parameter of the cosmos is comprehended to attain a zero value, we possibly ought to incorporate that the model universe presumed under this present investigation, professes like an isotropic cosmos.

Thus, the Standard Chaplygin Gas model divulges the competence of concurrently elucidating the origin of dark energy as well as dark matter which at an alike illustration podium , highly assesses the formation of dark matter preceding the formation of dark energy [3, 4] in the cosmos. This scenario clearly validates a cosmic background where equally the establishment of dark matter and dark energy can be undoubtedly exposed on supposition of a general fluid in the configure of Standard Chaplygin Gas which in subsequent eons has been mostly expectant to function as both Quintessence and Phantom conformations of dark energy correspondingly.

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Conflicts of Interest:

The author declares no conflicts of interest for this present study.

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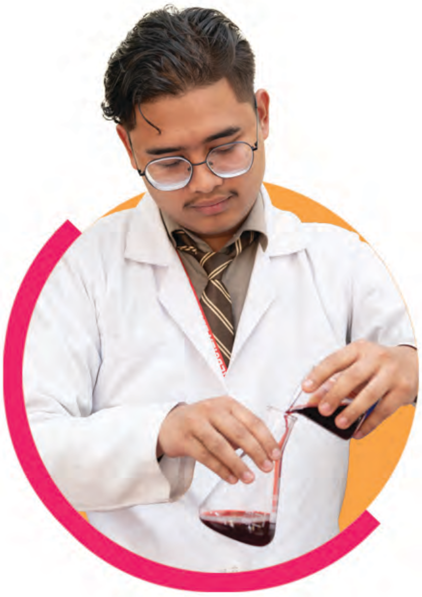

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Integrated MCA	5 Years	Pass in 10 + 2 (any Discipline) examination	IT,ITEs, Corporates, Banks,Govt. Services, NGO's.
MCA	2 Years	Graduation in any discipline, with 40% and above aggregate marks.	IT,ITEs, Corporates, Banks, Govt. Services, NGO's,Research
M.Tech - Water Resource Engineering	2 Years	Valid GATE Scorer with B.Tech /B.E in Civil Engineering or B.Tech /B.E in Civil Engineering with 60% marks	Research, consultant to Pvt. Organization in the field of flood forecasting, flood inundation, flood disaster management, Entrepreneur.
M.Tech - Structural Engineering	2 Years	Valid GATE Score with B.Tech/B.E., in Civil Engineering or B.Tech/B.E. in Civil Engineering with 60% marks.	Structural Engineer,Project Manager, Researcher, Quality Control, Teaching, Entrepreneurship, and more.
M.Tech - Computer science & Engineering	2 Years	Pass with 60% aggregate marks in B.Tech. (CSE or IT or ECE or EEE) or MCA or M.Sc. (IT or Computer Science) or equivalent	Offers opportunities in cutting-edge technology-based research like AI ML, Cybersecurity, and software development roles in the ever-evolving field of computer science.

Basic Science

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.Sc. Physics (Hons.)	4 Years	Pass in 10 + 2 with 40 % marks in Physics & pass in Maths	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
B.Sc. Chemistry (Hons.)	4 Years	Pass in 10 + 2 with 40 % marks in Chemistry	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
B.Sc. Mathamatics (Hons.)	4 Years	Pass in 10 + 2 with 40 % marks in Mathematics	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
M.Sc. Physics	2 Years	Graduate with 45 %(40 % in case of SC/ST/ OBC) marks in Physics	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
M.Sc. Chemistry	2 Years	Graduate with 40% marks in Chemistry	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
M.Sc. Mathematics	2 Years	Graduate with 40 % marks in Mathematics	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate

Liberal Arts

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.A. English (Hons.)	4 Years	Pass in 10 + 2 (any Discipline) with 40 % marks in English	Jobs in Govt., Teaching in Schools/Educational Administrators/ Corporate, Banks, Telecom, Media, Journalism
M.A English	2 Years	Graduate in any Discipline with minimum 45 % in English (40% in case of SC/ST/ OBC) aggregate marks	Jobs in Govt., Teaching in Schools/Educational Administrators/ Corporate, Banks, Telecom, Media, Journalism/ Research
B.A. Psychology (Hons)	4 Years	Pass in 10 + 2 (any Discipline) with 50 % (45% in case of SC/ST/ OBC) marks	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
M.A Psychology	2 Years	Graduate with 45 % in Psychology(40 % in case of SC/ST/ OBC) marks.	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
B.Sc. Psychology (Hons)	4 Years	Pass in 10 + 2 (any Discipline, with Economics or Maths as a combination subject) with 50 % (45%in case of SC/ ST/ OBC) marks	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
M.Sc. Psychology	2 Years	B.Sc Psychology degree from a recognized university with 45 %(40% in case of SC/ST/ OBC) marks in Psychology.	Teaching in Schools/ Colleges/ Educational Administrator/ Corporate
B.A. Journalism and Mass Communication	4 Years	Minimum10+2 (in any discipline) with 40% or above marks in aggregate	Reporter, Journalist, News Editor, or Photojournalist in print, electronic or digital media, Public Relations Officer,Content Writer/ Developer for websites, blogs and social media, Filmmaking and Radio jockey, Advertising campaigns, Social Media Manager
B.Sc. Journalism and Mass Communication	4 Years	Minimum10+2 (in Science Stream) with 40% or above marks in aggregate	
M.A. Journalism and Mass Communication	2 Years	Minimum Graduation (in any discipline) with 45% or above marks in aggregate	Director of Communications for advertising campaigns, Content writer/ Developer for websites, blogs and social media,Journalist/ Photojournalist, Filmmaking and Radio Jockey (RJ),Screenwriter, Sound Engineer, TV Correspondent, Producer, Art Director, Technical Communication Specialist, Web Producer
M.Sc. Journalism and Mass Communication	2 Years	Minimum B.Sc. or B. Tech Degree with 45% or above marks in aggregate.	

Law

Program	Duration	Eligibility	Career Prospects Employment Opportunities
BBA-LLB Integrated	5 Years	Pass in 10 + 2 with minimum 45 % (40 % in case of SC/ST, 42% in case of OBC) aggregate marks	Corporates, Banking, Judiciary, Legal Practice, NGO's IPR
BA-LLB Integrated	5 Years	Pass in 10 + 2 with minimum 45 % (40 % in case of SC/ST, 42% in case of OBC) aggregate marks	Corporates, Banking, Judiciary, Legal Practice, NGO's IPR
LL.B	3 Years	Graduate in any Discipline with minimum 45 % (40 % in case of SC/ST, 42% in case of OBC) aggregate marks	Corporates, Banking, Judiciary, Legal Practice, NGO's IPR
LL.M	2 Years	Graduate with LLB degree (Recognised by BCI)	Corporates, Banking, Judiciary, Legal Practice, NGO's IPR,Research

Management & Commerce Studies

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.Com (Hons.)	4 Years	Pass in 10 + 2 examination in commerce or Science with 45% (40% in case of ST/ SC/OBC) marks	Banks, Financial Services, Corporates
BBA	3 Years	Pass in 10 + 2 (any Discipline) examination with minimum 40% marks	Banks, Financial Services, IT, Insurance, Telecom,Corporates, Consulting Companies.
B.A. Economics	4 Years	Pass in 10 + 2 (any Discipline) examination with minimum 40% marks	Financial Analyst/ Investment Banker/ Risk Manager/ Actuary/ Public Sector Policy Analyst/ Economic Advisor/ Public Sector Economist/ Central Bank Analyst/ Management Consultant/ Trade Specialist/ Data Analyst/ Statistician/ Market Research Analyst/ Startups and Business Ventures
B.Sc. Economics	4 Years	Pass in 10 + 2 with minimum 45 % marks in Mathematics	Financial Analyst/ Economist /Management Consultant /Data Scientist/ Public Policy Analyst/ Financial Manager/ Marketing Manager/ Research Analyst/ Economic Advisor/ Statistician/ Market Research Analyst/ Startups.
MBA	2 Years	Graduate in any discipline with minimum 50 % (45 % in case of SC/ST/OBC) aggregate marks	Banks, Financial Services, IT, Insurance, Telecom, Corporates, Consulting Companies, Research
Executive MBA	2 Years	Graduation in any discipline with 45% and above aggregate marks, with a minimum of two years of work experience.	Banks, Financial Services, IT, Insurance, Telecom, Corporates, Consulting Companies, Research
M.Com	2 Years	B.Com with 45%(40% in case of ST/SC/OBC) Marks	Banks, Financial Services, Corporates
Master of Hospital Administration (MHA)	2 Years	Graduate with 40% aggregate marks (Preference will be given to MBBS, BDS, BHMS, B.Sc Nursing, BPT, BAMS, B.Sc Allied Health Science, Bioscience, General Science, Veterinary Sciences & B.Sc Pharma)	Hospitals(Government /Private), NUHM, NRHM, NRLM, Healthcare consultancy firm, Hospitality industry, Medico-legal consultancy firm, Insurance sector (Government/ Private)
M.A Economics	2 Years	Candidates must hold BA/B.Sc. Honours degree in Economics with a minimum of 45% aggregate marks (or equivalent).	Public Policy Analyst/ Economic Advisor/ Central Bank Analyst/ Trade Specialist/ Public Sector Economist/ Management Consultant//Professor/ entrepreneurial ventures in policy-related domains.
M.Sc. Economics	2 Years	Candidates must hold a B.Sc. Honours degree in Economics with a minimum of 45% aggregate marks (or equivalent).	Data Scientist/ Financial Analyst/ Risk Manager/ Statistician/ Econometrician/ Research Consultant/ Actuary roles in think tanks of international organizations, and academic institutions.

Allied Health Sciences

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.sc. in Emergency Medical Technology	4 Years	Pass in 10 + 2 (Science Discipline) with 45% marks in PCB (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government /Private hospital having ICU/ITU/Critical care unit, Demand in disaster management team for both state/central government, army/navy/airforce. Eligible for Post graduation courses.
B.sc. in Cardiac Care Technology	4 Years	Pass in 10 + 2 (Science Discipline) with 45 %marks in PCB (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government /Private Hospitals in cardiology department, different cath- labs or diagnostic centers. Eligible for postgraduate courses.
B.sc. in Dialysis Therapy Technology	4 Years	Pass in 10 + 2 (Science Discipline) with 45 % marks in PCB (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government /Private hospitals, NRHM, NUHM, NGO, clinics/ healthcare setup offering dialysis treatment. Eligible for Post Graduation courses in dialysis.
Bachelor in Health Information Management	4 Years	Pass in 10 + 2 (any Discipline) with 45 % marks (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government / Private hospitals, diagnostic centers, NRHM/ NUHM, legal firms,Healthcare consultancy .Eligible for Post Graduate courses.
B.Sc. Medical Lab Technology (BMLT)	4 Years	Pass in 10 + 2 (Science Discipline) with 45% marks in PCB (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government /Private hospital having ICU/ITU/Critical care unit, Demand in disaster management team for both state/central government, army/navy/airforce. Eligible for Post graduation courses.
B.Sc. Medical Lab Technology (BMLT) (LE)	3 Years	Pass in 3 years diploma with 45% marks in aggregate (5% relaxation for SC/ST/OBC Candidates)	Opportunity in Government /Private hospital having ICU/ITU/Critical care unit, Demand in disaster management team for both state/central government, army/navy/airforce. Eligible for Post graduation courses.
Master in Medical Lab Technology (MMLT)	2 Years	Candidate must have passed degree, e.g. B.Sc. MLT/ B.Sc. Physiology/ Microbiology/ Biotechnology/ Biochemistry or equivalent B.Sc. Biosciences from a recognized University	Opportunity in Government / Private sector, Lab Technician, Medical Lab Incharge, Research and Development Manager (Laboratory),Technical Officer etc. Can pursue research or can flourish in academics as well

Education

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.Ed	2 years	Graduate or post graduate in any discipline with minimum 50 % (45 % in case SC/ST/ OBC) aggregate marks	Teaching in Secondary level
MA - Education	2 years	Graduate in any discipline	Teaching in Schools/Educational Administrators/ Research
M.Ed	2 years	B.Ed. (1/2 years)/ B.EL.ED/B.Sc.B.Ed./B.A B.Ed./ D.EL.Ed. /D.Ed. with a Bachelors degree. 50% marks at all the levels	Teaching in Teacher Education

Physical Education

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.P.Ed	2 years	Pass in graduation in any discipline and as per university selection procedure.	Jobs in School/ College/ Physical Trainer
D.P.Ed	2 years	Pass in 10+2 or equivalent with 50% of marks in any stream	
BPES	3 years	Pass in 10 + 2 examination or equivalent from any recognised education Board/ University	
BPES(LE)	1 year	Pass in two years diploma in Physical Education	
MPES	2 years	Candidates must have passed with at least 50% marks for Gen/OBC and 45% for SC/ST category. B.P.E.D (4yr. integrated) /B.P.E.D (1yr. or 2yr.)/B.P.E (3yrs.)/ B.sc (Physical Education)/ B.P.E.S (3yrs.)	Jobs in School/ College/ University, Physical Trainer/Sports/ Job in Govt. and Private sector as teacher, instructor, coach etc.

Yoga & Naturopathy

Program	Duration	Eligibility	Career Prospects Employment Opportunities
PGDYET	1 year	Any graduate	Yoga Teacher in Schools, Yoga Therapist/ Yoga Psycologist/ Yoga Inspector in MNC's, Health Club,Yoga Club
B.A. in Yoga	3 years	Pass in 10 + 2 (Arts/Commerce) with minimum 40% aggregate marks.	
B.Sc. in Yoga	3 years	Pass in 10 + 2 (Science) with minimum 40% aggregate marks.	

Special Education

Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.Ed.Spl.Ed. (ID)	2 years	Graduate or post graduate in any discipline with minimum 50 % (45% in case SC/ST/ OBC) aggregate marks	Teaching in Secondary level and at special schools
D.Ed.Spl.Ed. (IDD)	2 years	Pass in 10 + 2 (any Discipline) with minimum 50% (45 % in case SC/ ST/ OBC) aggregate marks.	Special schools, Sarva Siksha Abhiyan/ Resource teacher in General School/ Integrated/ Inclusive setup
M.Ed.Spl.Ed.(ID)	2 years	B.Ed. Spl. Ed (ID) / B.Ed. General with D.Ed. Spl. Ed (ID) with 50% marks (RCI).	Professional preparation of teacher educators- engaged in continuous professional development of teachers
Integrated B.A./ B.Com /B.Sc./ B.Ed. Spl.Ed.	4 years	Pass in 10 + 2 with 50% marks	Teaching in Secondary level and at special schools
Integrated B.A. B.Ed. Spl. Ed. (Visually Impaired)	4 years	Pass in 10 + 2 (any Discipline)	They can appear the CTET and TET exam i.e. for Central and State Level, RCI Registered Rehabilitation Professional in Clinic, Nursing home, Hospitals, Counseling centers, Special Educator or Children with Visual Impairment in Inclusive school, Special school and General school.

Clinical Psychology

Program	Duration	Eligibility	Career Prospects Employment Opportunities
M. Phil in Clinical Psychology	2 years	M.A / M.Sc degree in the Psychology with 55% marks in aggregate, Preferably with special paper in Clinical Psychology .	Qualified professional & extensive inputs & widespread Clinical experience to acquire the necessary skills in the area of Clinical Psychology

Library And Information Sciences

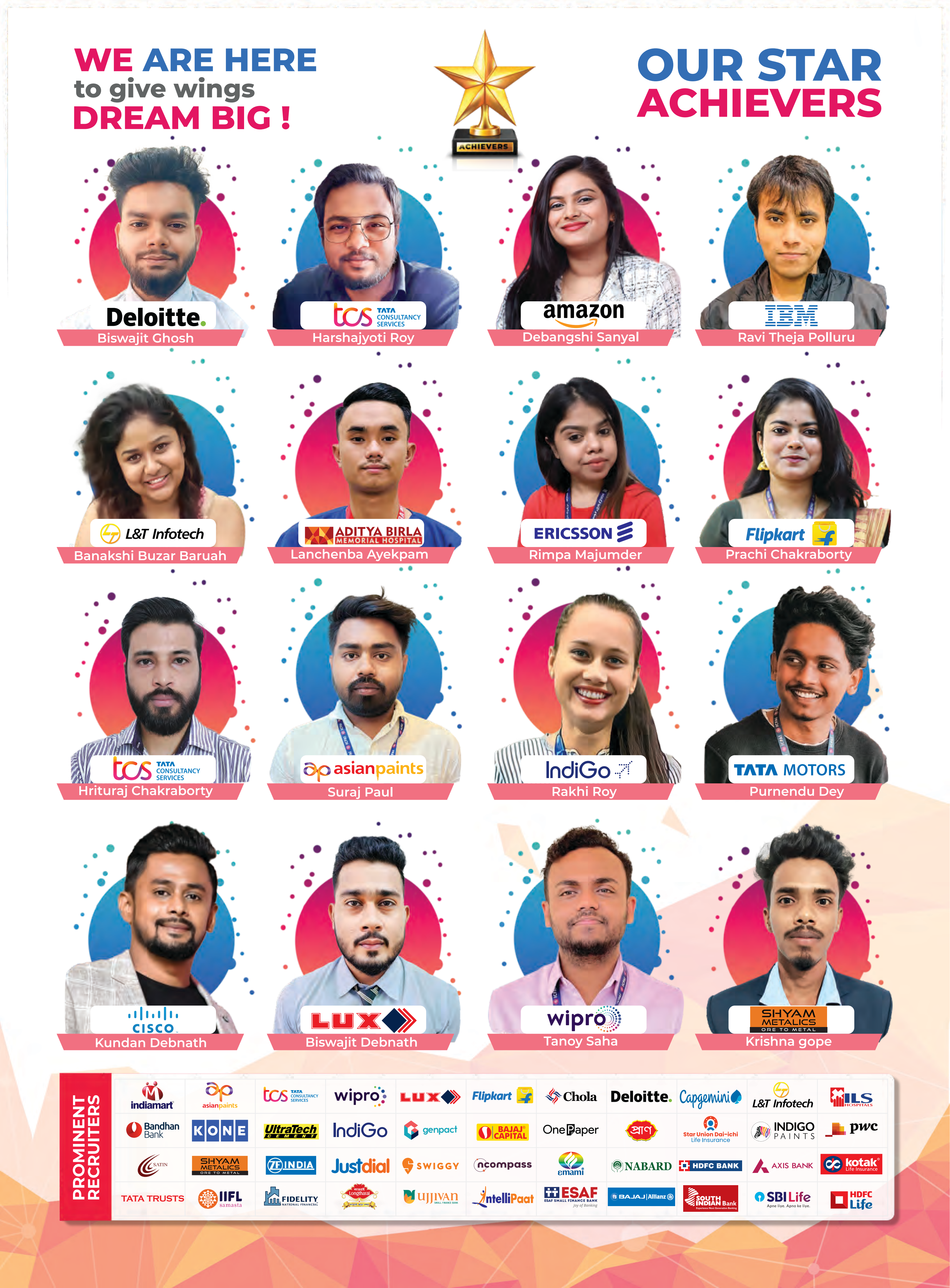
Program	Duration	Eligibility	Career Prospects Employment Opportunities
B.Lib.I.Sc.	1 Year	Graduate in any discipline	School/ College/ University/ district/ State / National Librararies, Bank, Govt. Services, NGO's, Research
M.Lib.I.Sc.- Int.	2 Years	Graduate in any Discipline	
M.Lib.I.Sc.	1 Year	Graduate with B.Lib.I.Sc	

Nursing

Program	Duration	Eligibility	Career Prospects Employment Opportunities
GNM	3 years	10+2 with English and must have obtained a minimum aggregated score of 40% marks for the general candidates for any stream • 35% SC/St candidates marks required from any stream • Age should be 17-35 (and for SC/ST 5 years relaxation) • Boys & Girls both are eligible	Hospitals(Government /Private), NUHM, NRHM, NRLM, Healthcare consultancy firm, Hospitality industry, Medico-legal consultancy firm, Insurance sector (Government/ Private)

P.hD

Program	Duration	Eligibility	Career Prospects Employment Opportunities
Engineering (CE, CSE, ME, ECE,EE), Science (Physics, Chemistry,Mathematics),Allied Health Sciences (Molecular Biology, Clinical Bacteriology, Clinical Biochemistry), Management (OB, HR, Marketing, Finance), Economics, Commerce, Law, English, Psychology, Education, Spl. Education, Sociology, Physical Education, Political Science, Philosophy	4 years	A two-year postgraduate degree or equivalent from a recognized Institution, with 55% marks or equivalent CGPA in concerned subject. or A regular, full time M.Phil degree from any recognized University	Faculty position, Scientist, Post-doc researcher



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- Medical center featuring on-site residential doctors and nurses.
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- 24 Hours power generator back-up etc.
- Full campus is covered by JIO Wi-Fi, ICFAI ***Wi-Fi 6***

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