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Advanced Studies in Multidisciplinary Research Vol. 2

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PREFACE

We are delighted to publish our book entitled “Advanced Studies Multidisciplinary Research Vol.2". This book is the compilation of esteemed chapter of acknowledged experts in the fields of Chemistry. This book is published in the hopes of sharing the excitement found in the study of Chemistry. We developed this digital book with the goal of helping people achieve that feeling of accomplishment. The chapters in the book have been contributed by eminent scientists, academicians. Our special thanks and appreciation goes to experts and research workers whose contributions have enriched this book. Finally, we will always remain a debtor to all our well-wishers for their blessings, without which this book would not have come into existence.

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Advanced Studies

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CHAPTER 1
ALL ABOUT "MATRICES"

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Introduction

We often present an arrangement of numbers (or symbols, elements) mn in the form of a rectangular or square array of number enclosed by a pair of bracketssubject to certain rule of operation in m rows(horizontal lines) and n columns(vertical lines). Some cases are given below:

Case 1. If Abhishek secures 50 marks in English and 70 marks in Science, we may express this as [50 70] or (50 70).

Case 2. If Dolly secures 50 marks in English, 70 in Scienceand 80 in Statistics, then we may express this as

[50 70 80), or, (50 70 80)

Case 3. Marks obtained by three students Abhishek, Sneha andAshutosh in English, Science and Statistics are as follows:

	English	Science	Statistics
Abhishek	50	70	80
Sneha	70	78	75
Ashutosh	55	25	58

$$\begin{bmatrix} 50 & 70 & 80 \\ 70 & 78 & 75 \\ 55 & 25 & 58 \end{bmatrix} \quad \text{or} \quad \begin{pmatrix} 50 & 70 & 80 \\ 70 & 78 & 75 \\ 55 & 25 & 58 \end{pmatrix}$$

This square array consists of three rows and three columns. The first row indicates the marks obtained by Abhishek in English, Science and Statistics respectively, second by Sneha in the three respective subjects and third Ashutosh in the three subject respective subject. The first column refers to the marks obtained by Abhishek, Sneha and Ashutosh in English, the second column in Science and the third in Statistics.

Such a Square array, subject to certain rules of operation is called a matrix. Thus (2) is a matrix consisting of three rows and three columns, i.e., it is 3 x 3 (read3 by 3) matrix; (1) is a matrix consisting of one row only, i.e., it is a 1 x 3 matrix and we call it a row matrix. Now we give below the proper definition of a matrix.

Definition

A set of mn numbers (real and complex) arranged in rectangular or square array having m rows and n columns, the number being enclosed by bracket is called an (m by n) matrix.

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An m ×n matrix is usually written as $\begin{bmatrix} a11 & a12 \\ a21 & a21 \end{bmatrix}$ thus a11 is the element lying in the first row and first column, aij is the lying in the ith row and jth column

Thus m×n matrix A may be written as

A= (a_{ij}) m×n where i = 1,2,3,4……., m=1,2,3,4,5……..

- **Note –**
- if all element of matrix are real number then matrix is to be real matrix
    - if all element of matrix arecomplex number then matrix is to be complex matrix
    - if the number of row is equal to the number of columnthen its called square matrix. A square matrix having n row and n columns is called " a square matrix of order n " or" an n- rowed square matrix
    - if the number of row is not equal to the number of column then its called rectangular matrix

Practical application of matrix:-

Computer Graphics: Matrices help may area in computer graphics like 3D modeling, and animations in video games, movies, and apps

Cryptography: Used of matrix in cryptography like -encoding and securing information in digital communication.

Navigation Systems: In Navigation system matrices represent travel times and distances between multiple locations, GPS and mapping system are also use matrices to calculate routes.

Weather Forecasting: Matrices help in processing data from satellites and sensors to predict weather patterns.

Economics and Finance: In economics and finance area the use of matrix like modeling and solving problems related to investments, supply and demand, and optimization.

Types of Matrices

1. **Row matrix and column matrix -**
    - **Row matrix** - a matrix having only one 1×n order element or only one row is called a row matrix (or row vector)

Example [a_{11},a_{12},a_{13},a_{14}……..$a_{1\times n}$]

- **column matrix** - a matrix having only one n ×1order element or only one column is called a column matrix (or Column vector)

example -

$$\begin{matrix} a11 \\ a21 \\ a31 \end{matrix}$$

- **Null matrix**– A Matrix whose all element are zero of any order (rectangular or Square) is called null matrix .

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Ex- $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Null matrix is singular and does not have an inverse matrix

Diagonal matrix – a square matrix is called diagonal matrix whose all elements except those in the main diagonal are zero. The main diagonal can be constant or zero a diagonal matrix must fit the following form

$$\begin{bmatrix} d1 & 0 \\ 0 & d2 \end{bmatrix}$$

Ex- $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$

And $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ is also a diagonal matrix

if any of the diagonals of a diagonal matrix are zero , the matrix is singular and does not have an inverse matrix.

- **Scalar matrix -** a diagonal matrix having all diagonal elements are equal to a constant value is called scalar matix

$$\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

- **Identity matrix** a diagonal matrix having all diagonal element are equal to a constant value 1 is called identity matrix

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

5.Symmetric and skew – symmetric matrix

- **Symmetric matrix :** a square matrix A is called Symmeric matrix if its transpose is equal to its self $A = A^T$

aij =aji for all I and j i.e if (I,j)th element = (j,i)th element for example

$$\begin{bmatrix} 8 & 6 \\ 6 & 5 \end{bmatrix}$$

- **skew – symmetric matrix** a square matrix A is called Skew- Symmeric matrix if its transpose is equal to its self with negative sign $A = -A^T$

aij = -aji for all I and j i.eif (I,j)th element = - (j,i)th element for example

$$\begin{bmatrix} 8 & -6 \\ 6 & 5 \end{bmatrix}$$

- **6.Hermitian and skew Hermitian matrix**
- **Hermitian Matrix -** acomplex square matrix A is called Harmitian matrix if its own conjugate transpose is equal to its self $A = \bar{A}^T$

$$\begin{matrix} 5 & 3+7i \\ 3-7i & 2 \end{matrix}$$

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- **skew Hermitian matrix** - a complex square matrix A is called square Harmitian matrix if its own conjugate transpose is equal to its self with negative sign $A = -\bar{A}^T$

$$\begin{matrix} 5 & 3+7i \\ -3+7i & 2 \end{matrix}$$

- **Nilpotent matrix**- Asquare matrix A such that $A^k = 0$ where k is least positive integer(index), is called nilpotent matrix
  - ✓ If $A^3 = 0$ then it is nilpotent matrix of index 3
  - ✓ If $A^5 = 0$ then it is nilpotent matrix of index 5

$$\text{Ex} \begin{matrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$$

- **Involutory matrix**- a square matrix A is said to be involutory matrix if square of matrix equal to identity matrix i.e $A^2 = 1$

$$\text{Ex} \begin{matrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

- **Idempotent matrix**- a square matrix A is said to be Idempotent matrix if square of matrix equal to itself i.e $A^2 = A$

$$\text{Ex} \begin{matrix} 1/2 & 1/2 & 1/2 \\ 1/2 & 1/2 & 1/2 \\ 1/2 & 1/2 & 1/2 \end{matrix}$$

- **Orthogonal matrix**- a square matrix A is said to be Orthogonal matrix if the product of matrix A with its transpose matrix A' is equal to identity matrix i.e$AA' = I$

$$\text{Ex} \begin{matrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$

- **Singular and non-singular matrix**– A square matrix is called singular marix if its determinant is zero. A non singular matrix has a determinant that is not equal to zero

$$\text{Ex} \begin{matrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{matrix}$$ *this is non singular matrix*

$$\text{Ex} \begin{matrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$$ this is *singular matrix*

- **Diagonalizable matrix** -A matrix A is called a diagonalizable matrix if its similar to diagonal matrix i.e A is diagonalizable if its diagonal element D= diag(d1,d2,d3,d4…….)And non singular matrix P such that P^{-1} A P = D where P is matix of Eigen Vector
  - ✓ If matrix has distinct eigen value then matrix is diagonalizable.

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- ✓ if matrix is diagonalizalbe then its Algebric multiplication and Geometric Multiplication will be Equal

Ex- $\begin{matrix}1 & 5 & 7\\ 5 & 2 & 6\\ 7 & 6 & 3\end{matrix}$ this matrix is symmetric and also diagonlizable .

- **Unitary Matrix** – A matrix is said to be Unitary matrix if the product of matrix A with its conjugate transpose matrix $\bar{A}^T$. equal to identity matrix i.e $A\,\bar{A}^T = I$

Rules of Operations on Matrices

- **Multiplication oftwo matrix–** the multiplication of matrix $C_{i\,j}$ sum of product of ith row of first marix A and jth column of second matrix Bi.e$C_{i\,j}=a_{i1}\,b_{1j}+ a_{i2}+b_{2j}\ldots\ldots\ldots\ldots\ldots+a_{in}b_{nj}$
- **Addition of matrices** the sum of two matrix is a matrix obtaining by adding the corresponding element of the given matrix

Thus $\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}+\begin{bmatrix}b_{11} & b_{12}\\ b_{21} & b_{22}\end{bmatrix}=\begin{bmatrix}a_{11}+b11 & a_{12}+b12\\ a_{21}+b21 & a_{22}+b22\end{bmatrix}$

- **Subtraction of two matrices**Subtraction of matrices the Subtractof two matrix is a matrix obtaining by Subtract the corresponding element of the given matrix

Thus $\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}-\begin{bmatrix}b_{11} & b_{12}\\ b_{21} & b_{22}\end{bmatrix}=\begin{bmatrix}a_{11}-b11 & a_{12}-b12\\ a_{21}-b21 & a_{22}-b22\end{bmatrix}$

- **Scaler Multiplication of twomatrices**each entry of matrix **A**multiply by scaler value or any other constant valve is called scaler multiplication i.e C= k A

A= $\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}$ then C= $k\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}$ C= $\begin{bmatrix}ka_{11} & k_{12}\\ k_{21} & k_{22}\end{bmatrix}$

- **Transpose of matrix** if A m×n matrix obtain by interchanging the rows and coloumn of matrix A is called the transpose of matrix and denoted by A^T

A=$\begin{bmatrix}a_{11} & a_{12}\\ a_{21} & a_{22}\end{bmatrix}$ then $A^T = = \begin{bmatrix}a_{11} & a_{21}\\ a_{12} & a_{22}\end{bmatrix}$

- **Inverse of Square matrix -**A square matrix A of order m and if there are exist another square matrix of same order B and product of these matrix equal to indentity then matrix B is called inverse matrix of A and denoted by A^{-1}

A= $\begin{bmatrix}2 & 5\\ 1 & 3\end{bmatrix}$B= $\begin{bmatrix}3 & -5\\ -1 & 2\end{bmatrix}$

Then AB = $\begin{bmatrix}2 & 5\\ 1 & 3\end{bmatrix}\begin{bmatrix}3 & -5\\ -1 & 2\end{bmatrix}$ = I

- ✓ Note – if B is the inverse of A , the A is also inverse of B
  - o A rectangular matrix Dose not exist inverse
  - o If the number of row of first matrix and number of column of second matrixare not equal and determinant of matrix will be zero then does not posses inverse matrix

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- If A and B are invertible matrix then$(AB)^{-1}= b^{-1} A^{-1}$

Some important properties

- **Properties of addition of matrix**

2. **Commutative low –** if A and B are same order matrix then A+ B = B + A
3. **Associative low -** for any three matrix of same order A,B,C such (A+B)+C = A+(B+C)
4. **Existence of additive identity –** let A be n ×m matrix and O be n ×m zero matrix then A+O=O+A= A
5. **Existence of additive inverse —** let A be n ×m matrix andanother B be n ×m matrix then A+B=B+A= Identity (0) then B is the inverse of A

Properties of multiplication of matrix -

1. **associative law-** For any three matrices A, B and C i.e (AB) C = A(BC)
2. **distributive law-** For three matrices A, B and C i.e A(B + C) = AB + AC

(A + B) C = AC + BC whenever both sides of equality are defined.

3. **existence of multiplicative identity** For every square matrix A, there exist other matrix of B such that BA = AB = Athen matrix B Is a identity matrix

Solution of Linear Equations

Homogeneous system of equation

- let AX = B be a system of n linear equation in n variable if B = 0 then its a homogeneous equation
- If determinant of matrix does not equal to zero the system of equation is consistent has a **unique solution** and X= 0 which is called a trivial solution
- If determinant of matrix does equal to zero the system of equation is consistent has a**infinitely many solution** or non trivial solution

Non Homogeneous system of equation–

- let AX = B be a system of n linear equation in n variable if B ≠ 0 then its a Non Homogeneous equation
- If determinant of matrix does not equal to zeroA ≠ 0 the system of equation is consistent has a unique solution
- If determinant of matrix A =0 and (adj A)B≠0 then the system of equation **is inconsistent** and has a **no solution**

In other word

- Rank of [A :B] = rank of [A]= n Unique Solution
- Rank of [A:B] = rank of [A]≠ n Infinite solution
- Rank of [A:B]≠rank of [A] No Solution

Sylvester's Low

Let F v⟶ u be linear transformation then
rank of A + nullity of A= n where n is dimention of v

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CHAPTER 2
LASER AND ITS APPLICATION

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Abstract

Since their development in the 1960s, lasers—an abbreviation for Light Amplification by Stimulated Emission of Radiation—have transformed a broad range of scientific, industrial, medical, and technical domains. The physics of stimulated emission, population inversion, and optical resonators are among the basic concepts of laser operation that are thoroughly covered in this study. The classification of lasers according to their medium—solid-state, gas, liquid, and semiconductor—is further examined and important features like coherence, monochromaticity, and high intensity are highlighted. The study's primary goal is to investigate the various uses of laser technology. These include scientific research in spectroscopy and quantum computing, medicinal applications in surgery and diagnostics, fiber optic telecommunications, and precision cutting and welding in manufacturing. Femtosecond lasers and their effects on nanotechnology are among the new developments and trends covered in the study. This study highlights the laser's crucial role in influencing contemporary innovation and its future course across disciplines by assessing both its present and potential applications.

Keywords: Laser, laser radiation, light amplification, light emission.

Introduction of Lasers

The Evolution of History

Using Planck's law of radiation, which was founded on probability coefficients (Einstein coefficients) for electromagnetic radiation absorption and spontaneous and stimulated emission, Einstein provided the first theoretical underpinnings for the LASER and MASER in 1917. Following the reports of several scientists, including Alfred Kastler's proposal on optical pumping in 1950 and its demonstration by Brossel, Kastler, and Winter two years later, and R. W. Ladenburg's first theoretical description of stimulated emission and negative absorption in 1928 and its experimental demonstration by W. C. Lamb and R. C. Rutherford in 1947, Theodore Maiman was the first to demonstrate the earliest practical laser in 1960 . The optical pumping of synthetic ruby crystal with a flash lamp that produced pulsed red laser radiation at 694 nm was the basis for Maiman's first laser. In the 1960s, Iranian physicists Javan and Bennett created the first gas laser by combining He and Ne gases in a 1:10 ratio. In 1962, Nick Holon Ya created the first semiconductor visible-light-emitting laser, and R. N. Hall exhibited the first diode laser composed of gallium arsenide (GaAs) that emitted radiation at 850 nm. [1]

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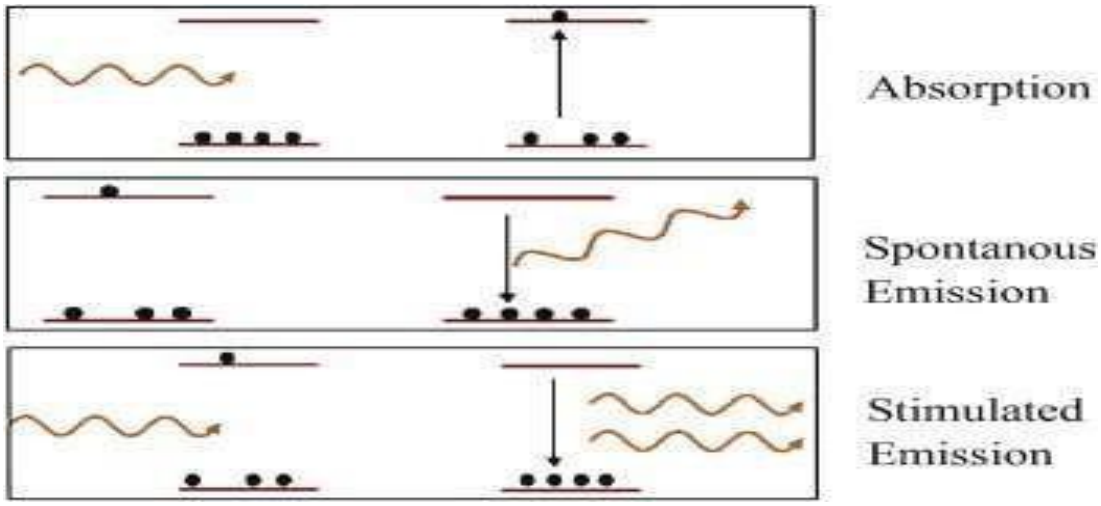
Principal of laser



• Stimulated absorption of radiation is the process of raising an atom's energy level by absorbing the stimulating incoming photon.

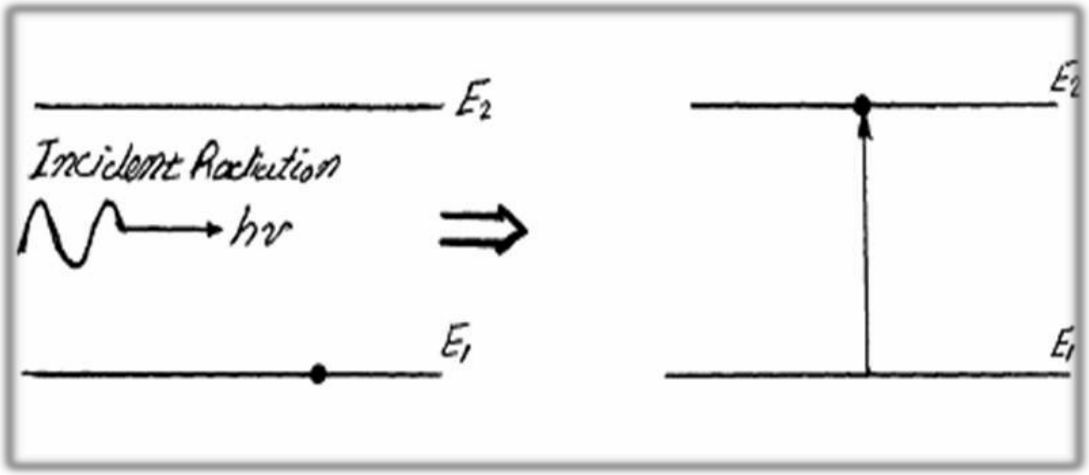


Fig. - Stimulated absorption

- Spontaneous emission of radiation is the process by which an excited atom moves on its own to a lower energy level.
- Stimulated emission of radiation is the process by which an excited atom, stimulated by an incident photon, transits to a lower energy level by emitting photons. [2]

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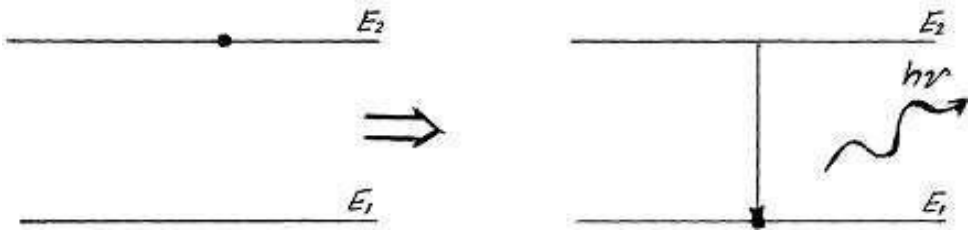

fig. - Spontaneous emission

- **Features of Laser Radiation:** Compared to traditional light sources, laser radiation has four advantages:
  (1) It is highly monochromatic.
  (2) It is highly directed.
  (3) It is highly coherent.
  (4) It has a very high intensity.

A LOT OF MONOCHROMATIC

Ordinary light has a bandwidth of roughly 1000 Å. Laser light has a bandwidth of roughly 10 Å. High monochromaticity refers to a laser light's narrow bandwidth. BANDWIDTH: Broadband is defined as the wavelength (Hz) spread around the wavelength of greatest intensity. Comparing laser light to traditional light sources, the former is more monochromatic. This monochromaticity allows for the concentration of a lot of energy into a very tiny bandwidth. For a high-quality laser:$\nu = 5 \times 10^{14}$ Hz $\Delta\nu = 50$ Hz For a typical sodium light, the degree of non-monochromaticity is significantly higher**.**

HIGH DIRECTIONALITY:

Light is emitted in all directions by standard light sources such as lamps, sodium lamps, and torch lights. We refer to this as divergence. However, a laser only emits light in one direction. This is known as laser light's directionality. Ordinary light spreads over a few kilometers, whereas laser light expands over many kilometers to a diameter of less than 1 centimeter. Divergence is a measure of a laser beam's directionality. Where r1 and r2 are the laser beam's radii at distances d1 and d2 from the source, $\Delta\theta = (r2 - r1) / (d2 - d1)$.Therefore, little divergence is necessary to achieve high directionality.

HIGHLY COHERENT:

Two light rays are considered coherent when their phase differences are independent of time. It is stated in terms of the light field's ordering.

Compared to other typical sources, lasers have a higher degree of ordering.

A laser beam with a diameter of 1 μm can provide tremendous power (10^{12} watts) in space due to its coherence alone.

Two separate notions of coherence exist:

1. Coherence of space
2. The consistency of time

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The capacity of two light waves at different points in space to sustain the same phase difference over time is known as spatial coherence.
The coherence length (Lc) of a He-Ne laser is roughly 600 kilometers. This indicates that the light wave maintains its phase across a considerable distance.
The coherence length is only around 3 cm in sodium light, which is significantly shorter.
The following formula illustrates the relationship between monochromaticity and coherence:
xi = (Δ_f / f) ∝ 1 / Lc
where
Lc is the coherence length.
f is the initial frequency.
Δ_f is the frequency change.
Xi is a number denoting coherence.
Therefore, light is more monochromatic (having only one color or wavelength) when Lc is large and xi is small.
TEMPORAL COHERENCE:

The length of time that a light wave's phase remains constant over time is known as its temporal coherence.
• The coherence time (tc) of a He-Ne laser is around 0.001 seconds.
• It is substantially shorter for sodium light, at roughly 0.0000000001 seconds.
Formula:
xi = (△_f / f) ∝ 1 / tc
where tc is the coherence time. Light that has a greater tc remains in phase for a longer period of time, making it more monochromatic.
HIGH INTENSITY: The energy a wave carries per unit time per unit area is known as intensity.
Intensity = Energy / (Time × Area) is the formula.
• Light is dispersed in all directions by standard light sources, such as bulbs. Since a laser concentrates light in a single direction, all of the energy remains in a narrow beam, whereas the energy disperses and weakens with distance. The light is extremely powerful as a result.
Example: The power entering the eye from a 100 W bulb at a distance of 30 cm is roughly 1/1000 of a watt. However, laser light is considered to have considerable intensity since its energy is concentrated in a tiny area of space and within a restricted wavelength.
Laser Power Range:
• A gas laser has a power of roughly 10^{-3} watts (0.001 W).
• The maximum power for a solid-state laser is around 10^{9} watts (1,000,000,000 W).

Fundamental Words:

Absorption is the process by which an atom transitions from its ground state to a higher energy level by absorbing energy from an external source in the form of a photon (hv).

Atom + hv → Atom* is the reaction.

where Atom* denotes the excited state of the atom and hv is the energy of the incoming photon. [3]

Comparing laser and regular light

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Normal illumination laser	Because ordinary light is composed of radiation with multiple wavelengths, it is polychromatic.Since laser light only has one wavelength, it is monochromatic.
Since ordinary light spreads in all directions, it is divergent. Since laser light only moves in one direction, it is non-divergent.	Ordinary light has less intensity.
due to a lower photon concentration Due to a larger photon concentration, laser light has a higher intensity.	Normal light is not Coherent The coherence of laser light is high.
Ordinary light is not as brilliant because of its decreased intensity. Because of the laser light's tremendous intensity, it is very brilliant.	For instance, Examples of sunlight include laser light.

Ground State and Excited States:

When every electron in an atom is in the tightest feasible orbit around the nucleus, the atom has the lowest energy level. The "ground state" is the name given to this energy level.An atom's electrons may go to outer orbits when one or more of them absorb energy. The "excited state" is the energy level at which the atom is in an excited state.Typically, excited states are unstable. Light is the result of electrons releasing excess energy as they descend from higher energy levels to lower ones. Interaction of Radiation with Matter:1. Induced Absorption or Stimulated Absorption: An atom transitions from its ground state (energy E1) to its excited state (energy E2) when it absorbs a photon with energy h × f, where f is the photon's frequency.This procedure is called stimulated absorption, or induced absorption, or simply absorption.The energy differential is determined by E2 - E1 = h × fw here E1 is the ground state's energy. E2 is the excited state's energy.

Planck's constant (h) and the absorbed photon's frequency(f)

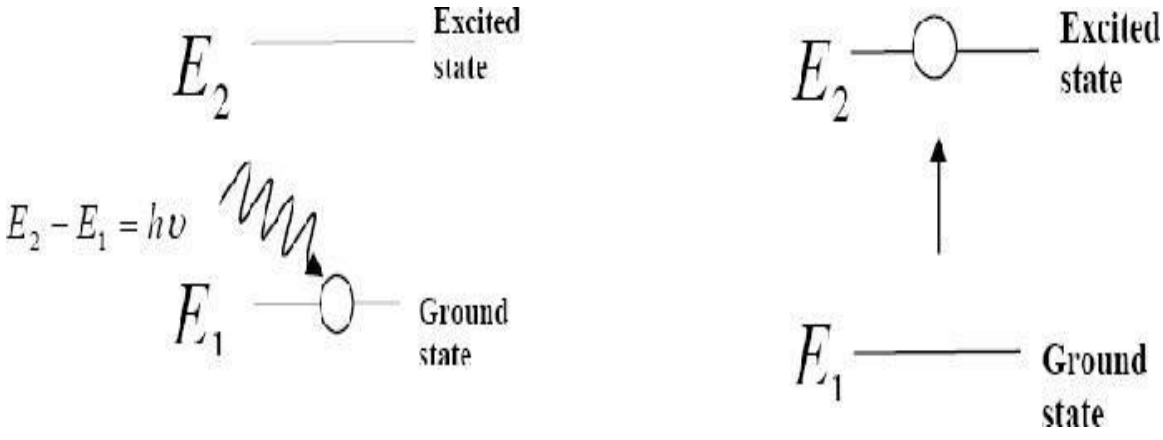

Fig. - Ground State and Excited States

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Each atom will absorb the energy from the incident photon and transition to the excited state if there are a large number of atoms in the ground state.

- The energy density of the incident radiation (ρ nu)
- The number of atoms in the ground state (N1)
- Then proportional to the rate of absorption (R12).

where the likelihood of an absorption transition per unit of time is given by the constant B12.

1 spontaneous emission

An atom's inherent propensity is to look for the structure with the lowest energy. As seen in the image, the excited atoms tend to return to the lower state by sacrificing the extra energy h × f rather than remaining in the excited state for an extended period of time. Without any external energy, the excited state E2 atom emits a photon with energy h × f, which returns it to the ground state E1.Spontaneous emission is the term for this type of radiation release that is not caused by an outside force. There is no way to restrict this emission.

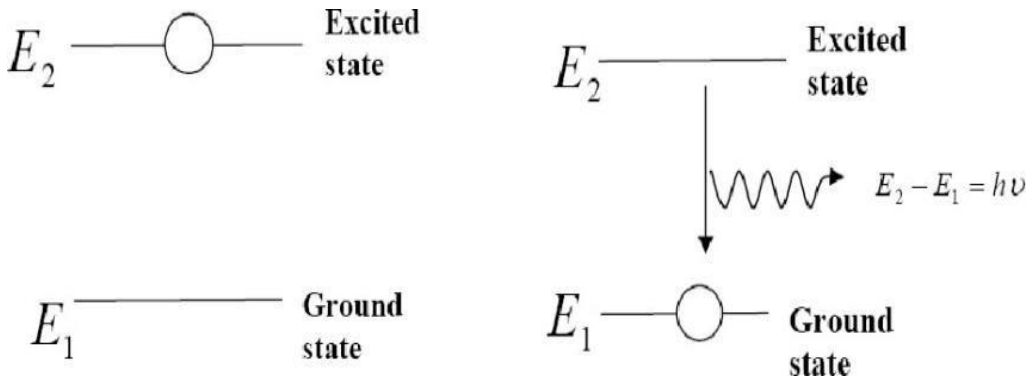

Fig. - spontaneous emission

The spontaneous emission rate The quantity of atoms or molecules in the excited state determines R21 (Sp). In other words, R21 (Sp) ∝ N2.

Where:

• Rate of spontaneous emission (R21 (Sp))

• N2 is the number of excited-state atoms.

$$R21(Sp)=A21N2$$

Where A21 is a constant that gives the probability of spontaneous emission transitions per unit time.

2. Stimulated emission

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The figure depicts the atom in the excited state E2. The atom can be stimulated to transition to its ground state by a

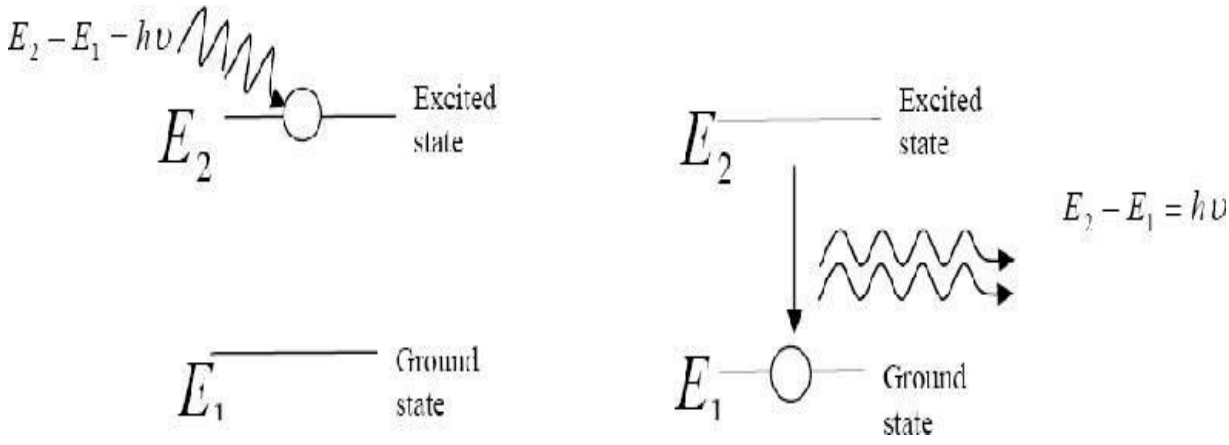

Fig.- **Stimulated emission**

photon of energy hr. An extra photon with the same energy, h^0, is released by the atom throughout this process. This technique is referred to as stimulated emission since an external photon is used to activate the emission.

The energy density of the incident radiation (ρf) and the number of atoms in the excited state (N2) determine the rate of stimulated emission R21 (St).

That is:

R21 (St) ∝ ρf × N2

$$R21(St)=B_{21}\rho_{\nu}N_2$$

Where the probability of stimulated emission transitions per unit of time is given by the constant B21. [4]

Various kinds of lasers

(i) Three-level laser, or ruby laser

The laser is solid-state. Maiman was the first to construct it in 1960. The laser has three levels. The active medium The active medium is a ruby crystal in the shape of a cylindrical rod. Ruby is a crystal of aluminum oxide (Al_2O_3) doped with 0.05% chromium ions. The rubber rod is roughly 10 cm long and 1 cm in diameter. The color of a ruby rod is pink.Pumping Technique: Here, the optical pumping technique is applied. A helical xenon flashlamp surrounds the ruby rod. Chromium ions possess suitable energy levels to produce lasers. The xenon tube's flash creates optical pumping. The pumping of the chromium ions uses only a portion of this energy. A cooling system is included to keep the Ruby rod cool because the residual energy warms up the device. The two optical resonators. The other face serves as a partial reflector and is slightly silvered.

(ii) Helium-Neon Laser (Four-Level Laser)

He-Ne laser was the first gas laser fabricated by Ali Javan and his coworkers. This laser's continuous power output makes it the most popular. The laser has four levels.

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Construction

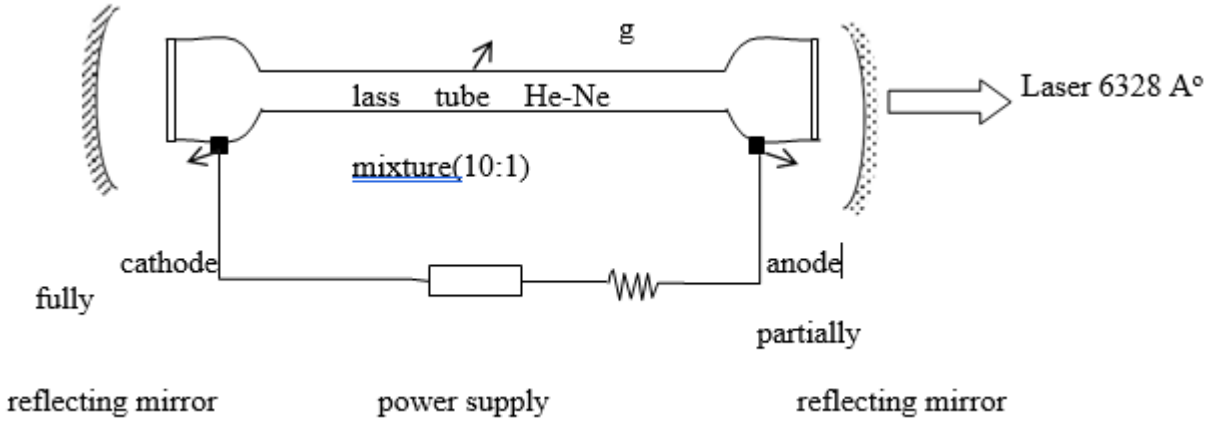

fig.- Helium-Neon Laser laser

Active medium: A long, narrow discharge tube that is roughly 90 cm long and 1 cm in diameter makes up the setup. A combination of He and Ne gases in a 10:1 ratio is poured into the discharge tube at a pressure of 1 torr (1 torr = 1 mm of Hg). The active medium is this mixture of gases. In this case, Ne atoms are the lasing agent, while He is the pumping agent. He atoms are more readily excitable than Ne atoms due to their greater mass and lighter mass.

Optical resonator: Two mirrors are mounted on the tube's axis. There is a mirror that is partially reflecting and one that is entirely reflecting.

Pumping Method: Pumping is accomplished via inelastic atom-to-atom collision.To create a gas discharge, electrodes are supplied and coupled to a high-voltage power source. The He atoms are excited when the electrons collide with them as they are driven from the cathode.Neon atoms experience population inversion as a result of the excited helium atoms transferring their energy to them.

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(iii) Semiconductor Laser: Solid-state lasers are semiconductor lasers. Gallium Arsenide (GaAs) p-n junction diode lasers were the first and most popular semiconductor lasers. Semiconductor lasers are used in CD players, laser printers, and other devices. The electron states in the valence and conduction bands are linked to the transitions in a semiconductor laser. The output is not crisp because the higher and lower energy levels are continuous.

Construction

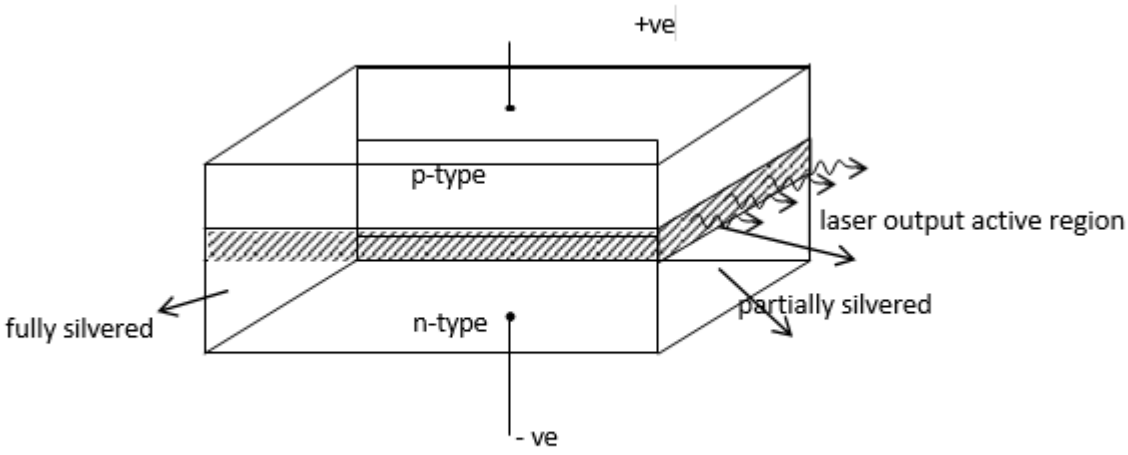

fig. - Semiconductor Laser

Two highly doped semiconductors combine to form a p-n junction, which makes up the semiconductor laser.

Active medium: In a semiconductor laser, the active medium is the depletion region. The depletion layer has a very thin thickness of only 1 μm.

Pumping Source: Conduction electrons will be injected into the junction area from the n-side, and holes will enter from the p-side when a forward-biased electric field is present. The depletion region will therefore get thinner as a result of the recombination of holes and electrons occurring there once more. The pumping method is the direct conversion method.

Optical resonator: A resonant cavity is created by the semiconductor's two faces that are perpendicular to the junction. To provide external connections, the diode's top and bottom faces that run parallel to the junction are metalized. Both the back and front faces have been roughened.[5]

Application of laser

Utilized in communication via fiber optics.
Used to create more potent laser diodes than LEDs.
Used for wound healing.
Utilized in laser printing.
Used to read barcodes.
Utilized for holographic recording and reconstruction.
Utilized in systems of communication.
Utilized in pattern recognition and barcode reading. [6]

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CHAPTER 3

अमरकांत की कहानियों में आधुनिक समाज एवं संघर्ष

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कहानी हमारे समाज में प्राचीन काल से विद्यमान रही है तथा मनुष्य कहानी को अपनी भावनाओं एवं संवेदनाओं को व्यक्त करने के माध्यम के रूप में प्रयोग करता आ रहा है। आधुनिक हिंदी साहित्य में सर्वाधिक लोकप्रिय विधा कहानी है। हिंदी साहित्य के प्रख्यात कहानीकार मुंशी प्रेमचंद कहानी को परिभाषित करते हुए कहते हैं - "सबसे उत्तम कहानी वह होती है, जिसका आधार किसी मनोवैज्ञानिक सत्य पर होता है।"1

भारत अंग्रेजों की 200 वर्षों की परतंत्रता से 1947 को स्वाधीन हुआ। इन वर्षों में भारतीय समाज की संरचना में परिवर्तन हुआ, देश की राजनैतिक एवं आर्थिक स्थिति अस्थिरता होने के कारण सामाजिक स्थिति में उसका गहरा प्रभाव पड़ने लगा फलस्वरूप भारतीय समाज में आधुनिकीकरण, औद्योगीकरण, नगरीकरण, मानव मूल्यों में ह्रास, निर्धनता, अशिक्षा, शहरी मध्यवर्गीय तथा निम्नवर्गीय जीवन, बेरोजगारी, पारिवारिक विघटन, अकेलापन, संत्रास, विसंगति, निर्थकता बोध तथा अलगाव आदि समस्याएँ उत्पन्न हुई। देश के समक्ष समस्याएँ सुरसा की तरह मुँह खोले हुए थीं ऐसे में साहित्य अपनी पूर्ण भूमिका निभा रहा था। हिंदी साहित्य की विभिन्न विधाओं में देश की परिस्थितियों का आभास मिल रहा था वहीं कहानी विधा में अपनी पुरानी परिपाटी को तोड़कर नए भावबोध के साथ साहित्य रचा जाने लगा। इस समय कहानी के क्षेत्र में नयी कहानी आंदोलन का अस्तित्व सामने आया। यह 1950 से 1965 का दौर था, जिसमें पुरानी पीढ़ी के उपेक्षित विषय वस्तु को केंद्र में रखकर नए शिल्पविधान और संवेदना को परिभाषित किया गया।

देश की तत्कालीन परिस्थितियों पर कहानीकार कमलेश्वर का कथन है -

"जब-जब विचारों का संघर्ष और जीवन की गति बहुत उग्र होती है तब-तब आदमी की मानसिक दुनिया का स्वरूप एकदम बदल जाता है।"2

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स्वातंत्र्योत्तर हिंदी कहानी में आधुनिक भावबोध के साथ अपनी पूर्व परंपरा का अनुसरण करने वाले कहानीकारों में अमरकांत प्रमुख स्थान रखते हैं। अमरकांत की यथार्थवादी लेखन शैली के कारण उन्हें मुंशी प्रेमचंद का अनुकरणकर्ता कहा जाता है। अमरकांत का जन्म 1925 में बलिया जिले में हुआ था। अमरकांत नई कहानी आंदोलन के साहित्यकार रहे हैं जिन्होंने अपने साहित्य में देश, समाज और व्यक्ति के विकृत रूप एवं भोगे हुए यथार्थ को अपनी कृतियों का विषय बनाया। अमरकांत की कहानियों में आधुनिक समाज के संघर्ष का मार्मिक वर्णन उक्त बिंदुओं द्वारा किया गया हैं।

मध्यवर्गीय जीवन

सामाजिक संरचना वर्ग पर आधारित होते हैं। भारत में पहले दो वर्ग उच्च वर्ग और निम्न वर्ग होते थे परंतु औपनिवेशिक काल के दौरान 19वीं शताब्दी के उत्तरार्द्ध में इन दोनों के मध्य एक तीसरा वर्ग भी दृष्टिगत हुआ जिनमें महत्वाकांक्षाएं उच्च वर्ग के समान हैं परन्तु यह वर्ग अर्थाभाव निम्न वर्ग के समकक्ष सहता है। मध्यवर्गीय व्यक्ति के जीवन में आर्थिक अस्थिरता, प्रदर्शनप्रियता, उच्च अभिलाषाएं, आत्मकेंद्रित तथा कल्पनप्रियता जैसी प्रवृत्तियां विद्यमान रहती हैं। मध्यवर्गीय जीवन पर गजानन माधव मुक्तिबोध का कहना है - "मध्यवर्ग की सांस्कृतिक चेतना, भारतीय प्राचीनता की गौरव भावना के नाम पर, सामंती संस्कार लिए हुए थी। उन संस्कारों को विभिन्न प्रकार गौरव भी प्रदान किया, अर्थात् उन संस्कारों के नये संस्करण भी हुए।"3

कहानीकार अमरकांत ने अपनी कहानी 'बहादुर' में कथावाचक के परिवार के माध्यम से मध्यवर्गीय परिवार के प्रदर्शनप्रियता को बहादुर नामक नौकर को नौकरी में रखने एवं उसका दिखावा करने के द्वारा प्रस्तुत किया है। मध्यम वर्गीय परिवारों में नौकर-चाकर रखना, उन पर अपना हुकुम चलाना उनके शान को दर्शाता है। वो अपने इस सम्पन्नता को अपने परिवारजन, अड़ोसी-पड़ोसी सबको दिखाने से भी नहीं चूकते हैं।

"कई बार पड़ोसियों को सुना चुका था जिसके पास कलेजा है, वही आजकल नौकर रख सकता है। घर के सवांग की तरह रहता है। निर्मला भी सारे मुहल्ले में शुभ सूचना दे आई थी - आधी तनखाह तो नौकर पर ही खर्च हो रही है, पर रुपया-पैसा कमाया किसलिए जाता है? ये तो कई बार कह ही चुके थे कि तुम्हारे लिए दुनिया के किसी कोने से नौकर जरूर लाऊँगा... वही हुआ।"4

मध्यवर्गीय व्यक्ति महत्वाकांक्षी होता है। वह बड़े सपने देखता है तथा उसे पूर्ण कर अपनी परिस्थितियों को सुधारने की इच्छा रखता है। इन मध्यवर्गीय परिवारों में आय के स्त्रोत का अभाव होता है परन्तु इस अभाव को पीछे छोड़ इनमें आगे बढ़ने की चाहत होती है। इसी महत्वाकांक्षा से ओत-प्रोत माता-पिता अपने संतान के उज्ज्वल भविष्य की कामना करते हैं। इसके लिए वे अधिक

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कार्य करते हैं ताकि जरूरत अनुसार धन एकत्रित कर सके, अपने आय से अधिक खर्च अपने संतान की सुविधाओं पर करते हैं, तथा अत्यधिक ऋण ग्रस्त होने पर भी चुप्पी साध लेते हैं। मध्यवर्गीय परिवार अपने बच्चों के रूप में अपने उन्नत जीवन के सपने संजोता है। अमरकांत ने 'डिप्टी कलेक्टरी' कहानी के पात्र शकलदीप बाबू जो अपने पुत्र नारायण को डिप्टी कलेक्टरी की नौकरी प्राप्त करने का स्वप्न देखते हैं जिससे उनके परिवार की स्थिति में सुधार हो जाए।

"सौ रुपए बबुआ को दे देना, आज ही फ़ीस भेज दें। होंगे, ज़रूर होंगे, बबुआ डिप्टी-कलक्टर अवश्य होंगे। कोई कारण ही नहीं कि वह न लिए जाएँ। लड़के के ज़ेहन में कोई ख़राबी थोड़े है। राम-राम...! नहीं, चिंता की कोई बात नहीं। नारायण जी इस बार भगवान की कृपा से डिप्टी-कलक्टर अवश्य होंगे।"5

अपने इसी स्वप्न की पूर्ति हेतु शकलदीप बाबू, नारायण की आवश्यकताओं का ख्याल रखते हैं और जरूरत की सारी वस्तुएं समय से पहले लाकर दे देते ताकि उसकी पढ़ाई में कोई व्यवधान न आए।

जीवन के प्रति आस्था या जिजीविषा

आज के इस आधुनिक समाज में मध्यम तथा निम्न तपके का व्यक्ति एक संघर्षशील जीवन यापन करने के लिए मजबूर हैं क्योंकि इनमें जीवन जीने की आस्था भरी होती हैं। ये जीवन के हर प्रकार की कठिनाइयों का सामना करते है चाहे वो समस्याएं बीमारी हो, आर्थिक विषमता हो या कोई सामाजिक कुरीतियां हो। इनके जीवन में अनेकों प्रकार की निराशा तथा हताशा होने के बावजूद वो अपने जीवन जीने की ईमानदार कोशिश करते हैं। इनकी यहीं कोशिश इनको अपने जीवन से जोड़े रखती है। इनमें अपने जीवन में कभी न हार मानने और अपने जीवन को अंत तक जीने की ललक देखी जाती है।

अमरकांत ने अपनी प्रसिद्ध कहानी 'जिंदगी और जोंक' के मुख्य पात्र रजुआ जो अकेला तथा अभावग्रस्त है उस पर चोरी का आरोप लगा कर मुहल्ले के लोगों द्वारा पिटाई की जाती है, उसके काम की उचित मजदूरी नहीं दी जाती वरन उसे काम के एवज में थोड़ा खाना दे दिया जाता है। उसके पास कुछ पैसे होते हैं उसे भी छीन लिया जाता है। उसे हैजा और खुजली की बीमारी होती है परंतु उसका देखभाल करने वाला कोई नहीं। रजुआ एक के बाद एक संघर्षों से घिरा रहता है फिर भी उसका जिंदगी के प्रति सकारात्मक दृष्टिकोण बना रहता है। कहानी के अंत में कहानीकार रजुआ के जिजीविषा के लिए कहता है -

"उसके मुख पर मौत की भीषण छाया नाच रही थी और वह ज़िंदगी से जोंक की तरह चिमटा था- लेकिन जोंक वह था या ज़िंदगी?वह ज़िंदगी का खून चूस रहा था या ज़िंदगी उसका? मैं तय न कर पाया।"6

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बेरोजगारी

बेरोजगारी आज आधुनिक समाज के उन्नति के पथ की बेड़ियों के रूप में सामने आया। हमारा समाज जब से विकास एवं आधुनिकीकरण के पथ पर अग्रसर हुआ तब से कई प्रकार की सामाजिक कुरीतियों को दूर करने की कोशिश की गई, शिक्षा में नवाचार लाया गया परन्तु इसके विपरीत रोजगार का स्तर दिन-ब-दिन और नीचे गिरता गया। पहले समाज में लोग पढ़े-लिखे न होने पर मजदूरी कर अपने एवं परिवारजन का पेट पालते थे परंतु आज के इस नवयुग के युवा पीढ़ी शिक्षित होने पर भी बेरोजगार हैं। आज हमें हर घर में कई बेरोजगार युवा नज़र आएंगे जो रोजगार के अभाव में आर्थिक अस्थिरता के बोझ तले दबे-कुचले, अभावग्रस्त, मानसिक तनाव युक्त जीवन यापन कर रहे हैं।

अमरकांत ने 'दोपहर का भोजन' कहानी में मुंशी चंद्रिका प्रसाद का परिवार निम्न मध्यवर्गीय जीवन का प्रतिनिधित्व करता है। मुंशी चंद्रिका प्रसाद को डेढ़ महीने पहले नौकरी में छटनी होने से बेरोजगार होना पड़ा। वहीं मुंशी का बड़ा पुत्र रामचंद्र पिछले वर्ष इंटर पास किया है और एक दैनिक अखबार में बिना तनख्वाह के प्रूफ रीडिंग का काम सीख रहा है उसके पास रोजगार नहीं है-

“वह एक स्थानीय दैनिक समाचार-पत्र के दफ़्तर में अपनी तबीयत से प्रूफ़-रीडरी का काम सीखता था। पिछले साल ही उसने इंटर पास किया था।”7

आर्थिक विपन्नता

आज जहां हमारा उन्नत समाज वैश्विक विकास के मार्ग पर अग्रसर है, वहीं अंधकारमय जीवन जीने को मजबूर समाज के निम्न तथा मध्य वर्ग अपने गरीबी की भीषण समस्या का सामना करने पर विवश हैं। गरीबी न केवल अपने आप में एक समस्या है वरन् ये समाज के कई अनेक समस्याओं का कारण भी हैं। वर्तमान समय में एक ओर निम्न वर्ग बेरोजगारी के कारण अत्यधिक गरीबी का सामना कर रहा वहीं दूसरी ओर मध्य वर्ग अपने आर्थिक विपन्नता को दूर करने के लिए अतिरिक्त प्रयत्न कर रहा हैं। 'डिप्टी कलेक्टरी' कहानी में साहित्यकार अमरकांत ने शकलदीप बाबू के द्वारा अपने अभावग्रस्तता के बावजूद अपने पुत्र नारायण के डिप्टी कलेक्टरी की परीक्षा हेतु 600 रु. का ऋण लेना उनके इसी आर्थिक विषमता से ऊपर उठने की हर संभव प्रयास को दर्शाता है।

“बबुआ को तुमने कभी यह तो नहीं बताया था कि उनकी फ़ीस तथा खाने-पीने के लिए मैंने 600 रुपए क़र्ज़ लिए हैं। मैंने तुमको मनाकर दिया था कि ऐसा किसी भी सूरत में न करना।”8

उसी प्रकार 'दोपहर का भोजन' कहानी में आर्थिक तंगी के कारण होने वाली समस्याओं पर प्रकाश डालते हुए कहानीकार ने मुंशी चंद्रिका प्रसाद के घर की दुर्दशा का यथार्थ चित्रण किया है। जहां एक ओर सिद्धेश्वरी अपने परिवार को सात रोटी, पनियाई दाल और चने की तरकारी खिलाकर परिवार के

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किसी भी सदस्य के समक्ष घर की अभावग्रस्त स्थिति को जाहिर नहीं करती है, वहीं दूसरी ओर लेखक सिद्धेश्वरी के छोटे बेटे प्रमोद की मार्मिक स्थिति दर्शाते हुए पाठकों पर निर्धनता का गहरा प्रभाव डालते हैं।

"लड़का नंग-धड़ंग पड़ा था। उसके गले तथा छाती की हड्डियाँ साफ़ दिखाई देती थीं। उसके हाथ-पैर बासी ककड़ियों की तरह सूखे तथा बेजान पड़े थे और उसका पेट हँडिया की तरह फूला हुआ था।"9

निराशा

हमारे आज के समाज में विभिन्न क्षेत्रों में उन्नति के नित्य नए आयाम दिख रहे हैं, परन्तु मनुष्य अंधकार एवं निराशा के गर्त में गिरता जा रहा है, जहां से बाहर निकलने का उचित मार्ग उन्हें नज़र नहीं आ रहा। असफलता, गरीबी, बेरोज़गारी जैसी समस्याएँ इसका मुख्य कारण हैं। वर्तमान समय में हताशा एवं निराशा आम जनमानस के लिए एक अभिशाप है।

नई कहानी आंदोलन की प्रमुख प्रवृतियों में से एक निराशा का चित्रण अमरकांत ने 'दोपहर का भोजन' कहानी के अंत में मुंशी चंद्रिका प्रसाद के घर की परिस्थितियों के द्वारा किया है। परिवार में आर्थिक तंगी, बेरोजगारी और भूख की समस्याओं के बावजूद उनको निश्चिंत होकर सोते हुए चित्रित कियागया है।

"सारा घर मक्खियों से भन-भन कर रहा था। आँगन की अलगनी पर एक गंदी साड़ी टँगी थी, जिसमें पैबंद लगे हुए थे। दोनों बड़े लड़कों का कहीं पता नहीं था। बाहर की कोठरी में मुंशी जी औंधे मुँह होकर निश्चिंतता के साथ सो रहे थे, जैसे डेढ़ महीने पूर्व मकान किराया नियंत्रण विभाग की क्लर्की से उनकी छँटनी न हुई हो और शाम को उनको काम की तलाश में कहीं जाना न हो।"10

'डिप्टी कलेक्टरी' कहानी के अंत में जब नारायण नौकरी प्राप्त करने में असफल हो जाता है तो पूरे घर में निराशा एवं हताशा की स्थिति छा जाती है। पूरा परिवार नौकरी मिलने के सपने संजोये हुए था परंतु घर की आर्थिक स्थिति सुधरने एवं समाज में मान प्रतिष्ठा प्राप्त करने की अभिलाषा इस सपने के टूटने के साथ ही समाप्त हो जाती है। नारायण पूरा शांत पड़ा रहता है तथा शकलदीप बाबू किसी चीज के छूट जाने के पश्चात उसको खोजने की असफल कोशिश की स्थिति में पहुंच जाते हैं। "अंत में वह साँस रोककर धीरे-धीरे इस तरह उठने लगे, जैसे कोई चीज़ खोजने आए थे, लेकिन उसमें असफल होकर चुपचाप वापस लौट रहे हों।"11

मानव मूल्यों का पतन

प्रारंभ से ही भारतीय संस्कृति में शिष्टाचार, परोपकार, निस्वार्थ सेवा जैसे सभ्य आचरण हमारे समाज का अभिन्न अंग रहा है। परंतु कुछ दशक पूर्व भारत गुलामी से आज़ाद हुआ परंतु दास्तां

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का प्रभाव जनसामान्य के मन पर एक अमिट छाप छोड़ गया। आज आम आदमी भारतीय संस्कृति एवं नैतिक मूल्यों को अपने से कोसों दूर करता जा रहा है। आज के इस बदलते परिवेश में नैतिक मूल्यों का पतन एक ज्वलंत मुद्दे के रूप में सामने आ रहा हैं। 'जिंदगी और जोंक' कहानी में नई साड़ी के चोरी के आरोप में रजुआ की बहुत पिटाई होती है तथा साड़ी शकलदीप बाबू के ही घर में मिल जाती है परन्तु शकलदीप बाबू के मन में कोई ग्लानि नहीं होती वरन् तुच्छ मानसिकता का परिचय देती है।

"चमार-सियार डाँट-डपट पाते ही रहते हैं। अरे, इस पर क्या पड़ी है, चोर-चाई तो रात-रातभर मार खाते हैं और कुछ भी नहीं बताते। फिर बायीं आँख को ख़ूबी से दबाते हुए दाँत खोलकर हँस पड़े- चलिए साहब, नीच और नींबू को दबाने से ही रस निकलता है।"12

स्वतंत्रता के समय राष्ट्र के समस्त नागरिकों को अपनी बुनियादी आवश्यकताओं रोटी, कपड़ा और मकान की पूर्ति के लिए संघर्ष करना पड़ा था साथ ही अवसरवादिता, भ्रष्टाचार आदि विसंगतियों के कारण यह संघर्ष और अधिक जटिल तथा विस्तृत होता रहा जिससे देश में मोह भंग की स्थिति उत्पन्न हुई। इसी यथार्थ को अमरकांत ने अपनी सहज लेखन शैली से साहित्य का विषय बनाया। अमरकांत की कहानियों में आधुनिक समाज की जटिलता एवं आम जनमानस के संघर्षशील जीवन का व्यापक रूप में वर्णन मिलता है। जीवन यापन करने हेतु संघर्ष करना मानव समाज को एक उन्नत एवं सुखद भविष्य की ओर ले जाता हैं परन्तु यदि संघर्ष ही जीवन का एक मात्र लक्ष्य बना रहे तो यह संघर्षमय जीवन एक उन्नत समाज के लिए अभिशाप बन जाता हैं।

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CHAPTER 4
TOOLS AND TECHNIQUES

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Abstract
In today's era, education research has become digitalized. At present, changes are being seen in research work. For research, we need data, data can be quantitative and qualitative. For a survey based research work, data can be obtained from primary and secondary sources. Different types of tools are used for data collection. Data collection in research has become modern through digitalization. Tools and technology are used to collect data. We can use tools and technology in digital form to collect data. A researcher can effectively organize the extensive information involved in modern research. Effective data use is important for a researcher who adds valuable knowledge to his field as well as provides innovation.

Keywords: Education, NEP 2020, Research, Digitalization, E-Data, Data Collection, Tool and Techniques

Introduction:
The word research is not being used for any modification or discovery of an object. This process also includes the sub-processes of exploration and research. In this word, the processes of inquiry, investigation, deep inspection, extensive testing, planned study, general determination with purpose and readiness are important according to the nature. Research is not a process that only investigates on the ground. In this, inspection is the main suffix. The second main idea is the specification of the problem. In this way, it can be said that research is the all-round analysis of a problem in a well-limited area. The problem begins with curiosity. A curious person can make the research work successful. In the absence of curiosity, this action is not possible in any form. Therefore, the emergence of curiosity in the mind is the basic foundation of research. The main goal of education is to develop and change the behavior of children. Through research work, importance is given to human development and welfare along with knowledge enhancement. These goals can be achieved through research and teaching activities. The process of studying the problems of teaching and the problems related to the development of child's behaviour is called educational research. Research is very important to bring innovation in the field of education. Educational research is needed to make the teaching learning process as effective as possible.

Research is something that seeks to acquire new knowledge. Research satisfies the instinct of curiosity. In today's age, it is important for researchers to use data effectively. It enables validation of original research findings, ensuring that the findings are reliable. By systematically organizing and analyzing research data, researchers can uncover patterns and trends that can lead to more impressive conclusions. Modern research generates large amounts of data, including digital, sensor, and survey data, as well as output from simulation software. Tools such as spreadsheets and laboratory notebooks are essential for organizing data. Organizing and integrating these data

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increases the quality and reliability of research. The use of digitalization is important in modern research, allowing researchers to make decisions and validate findings. Researchers employ effective data management and analysis techniques, leading to more comprehensive and impressive results. Data collection is analyzed with digitization and potential results are evaluated. Data can also be seen in this way. Research can be defined as, according to P.M. Cook, "Research is the search for facts, their meaning and utility in the context of a problem with honesty, detail and intelligence." Research is an effort to acquire new knowledge. An academic research is one that moves towards knowledge.

Research

The term research means proper study about a specific subject or concern using specific methods. To analyze an observed phenomenon, inductive methods of research are used. Inductive methods are related to qualitative. For verification of the observed phenomenon, deductive methods are used. Deductive methods are related to quantitative research. In determining the tools and techniques of the study, at this stage it is necessary for the researcher to determine those tools and techniques. By using which reliable and objective facts can be collected. These techniques are always selected keeping in mind the nature of the problem. At this stage it is also necessary to clarify the use of various tools and techniques because only by their proper use it is possible to collect correct facts. For example, schedule or questionnaire is a major technique of research and only by its proper construction and use can reliable information be collected. Data collection or research tools refer to the tools or instruments used to collect data, such as paper questionnaires or computer-aided interview systems. Questionnaires, interviews, rating and interest scales and tests are the main tools for collecting data. Broadly speaking, it allows comparison between the objectives set and the learning or tasks achieved. It is a very simple and useful technique for analyzing the scope of a particular skill or process, at various levels. Research tools refer to the instruments using which data is collected. This becomes the approach to data collection for the study. Research gets the right direction if the appropriate tool is used. Sometimes the need for more than one tool is reflected according to the nature of research. But overall it is only one tool, which helps us in data collection. From the research point of view, many tools exist today. Surveys, case studies, questionnaires, interviews, interest and interest scales are used today for data collection. But for any research instrument or psychological test to be qualitative it would be necessary that it possesses the following characteristics.

Data and Data Collection

Data is that which is to obtain or collect data in quantitative and qualitative form from primary and secondary sources for the topic taken in research work. And the result is known by collecting data and evaluating them. Tools are used to collect data, tools can be used both online and offline. Data collection is an essential step in all types of research, analysis and decision making, including research conducted in social sciences, business and healthcare. The researcher must identify the time of data collection, the type of data, the source of data and the methods being used. There are many different methods of data collection. And data can be quantitative and qualitative. Data can be divided into qualitative and quantitative. Qualitative data includes details such as color, shape, quality and appearance. Unsurprisingly, quantitative data deals with numbers, such as statistics,

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polling numbers, percentages, etc. Primary and secondary methods of data collection are two approaches used to collect information for research or analysis purposes-

1. Primary Data Collection

The first technique of data collection is primary data collection in which original data can be obtained directly from the source or through direct contact with the respondents. This method allows the researcher to obtain direct information in line with their research objectives.

There are various techniques for primary data collection, such as-

Survey and questionnaire- The researcher creates a questionnaire to collect data for research. The researcher can use the questionnaire to collect data both online and offline, such as mail, call, PDF, Google form, by sharing link etc. Data can be obtained from online and offline.

Interview- The researcher conducts interviews to collect data for research in which there is a dialogue between the researcher and the respondent. Researchers can conduct interviews for research online and offline to obtain data, online through video conferencing, phone calls, etc. Interviews can be structured (with predetermined questions), semi-structured (allowing flexibility) or unstructured (more conversational). Interviewing as a technique is mentioned, and it can be divided into different interview types or 'tools' such as:

Word association- The researcher gives the respondent a set of words and asks them what comes to their mind when they hear each word.

Sentence completion- Researchers use sentence completion to understand the respondent's thoughts. This tool involves giving an incomplete sentence and seeing how the interviewer finishes it.

Role playing- Respondents are presented with a hypothetical situation and asked how they would act or react if it were real.

Individual survey- The researcher asks the questions individually.

Online web survey- This survey is easy to complete, but some users are not ready to answer truthfully.

Mobile survey- Currently, mobile survey is being used to collect data through mobile. The use of mobile devices like SMS, app, tablet or smartphone has become easy.

Phone survey- No researcher can call thousands of people at once, so they need a third party to handle this work. Many people have call screening but they do not answer.

Observation- The researcher observes an event to collect data for research and prepares a record by observing the event. Observation is a simple and good method. Observation is more effective at a small scale. The researcher directly observes the event to collect data for research.

Experiment- The researcher controls the conditions for the experiment in collecting data for research and collects data for conclusion by observing the effect of variables for results and analysis.

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Focus group- It makes it easy to know the opinion, perception and experience of people. This method is an important method.

2. Secondary Data Collection

Published Sources- Researchers refer to books, academic journals, magazines, newspapers, government reports and other published materials which contain relevant data.

The following are the tools for collecting data for educational research work-

1. Observation - Direct observation of behaviour or events.

2. Interview - Face-to-face or telephonic conversation to collect in-depth information.

3. Sociometric Method - Use of sociometric method to collect data.

4. Questionnaire Method - All those tools are included under this, through which any information is being obtained. Its format is of questions and statements. The following tools are included in it - (1) Questionnaire, (2) Marking Scale, (3) Schedule, (4) Rating Scale, (5) Attitude Scale, (6) Mark Sheet.

5**. Psychological Tests** - Psychological tests are required to study the mental ability of the student. At present, many psychological tests are conducted, through which a researcher obtains a lot of information, which helps him in reaching his conclusion. The psychological tests that are currently being used are as follows: (1) Intelligence Test, (2) Achievement Test, (3) Interest Table, (4) Aptitude Test, (5) Personality Table, (6) Attitude Scale.

Data can be collected through the above tools, this work can be done manually and we can also do it digitally.

Research and Digitalization

For statistical analysis, there is statistical software like SPSSA Stata. For analyzing qualitative data, there is qualitative data analysis software like N Vivo. The tool for converting audio or video recordings into text is transcription software. For searching relevant research, there are literature databases like PubMed, Scopus and Web of Science. For organizing and managing citations, there is reference management software like Zotero and Mendeley.

Some of the main digital tools for data are-
Zotero
Mendeley
EndNote
Ithenticate
ScholarC
Scrivener
PaperPal
Trello
GantPro
Evernote

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Academic Search Engine
R Discovery
Google Scholar
Journal Selection Tool
Journal Finder
Global Journal Database

Earlier, research work was done manually, but with the passage of time, digital tools have made their place in research work. If we want to collect data, we can get it through Google Form or PDF, Word Document, link sharing, email. Currently, tools and techniques for collecting data are available in digital form. And a lot of information and resources are available online for the researcher. Along with the option to search and access data through digital tools, many tools are also available. A researcher is able to increase his efficiency and effectiveness for research work.

Major digital software for research

Stata - Stata is a powerful statistical software which is used in research work, and graphics can be made using quantitative data. Stata software is used in many areas. It can be said that Stata is used for statistical analysis in research work. The following tasks can be done with Stata: data management, statistical analysis, graphs and charts, preparing reports, etc. Stata software is available for Windows, Mac and Linux operating systems.

R Studio - It is a powerful tool for programming language. R Studio provides user interface. Data analysis is done in it. And graphics can be made using quantitative data in R Studio.

Jotero - Jotero is an open source tool used in research work. In Jotero, sources of articles, books, documents and web pages can be collected. Using Jotero, a personal library can be created. A researcher can obtain data from databases, websites and libraries for his research work.

Semantic Scholar - Semantic Scholar is a type of database. Semantic Scholar started as a database related to the subjects of computer science, geology and neuroscience. In Semantic Scholar, researchers are doing research work on machine learning, human computer interaction and artificial intelligence.

Mendeley - Mendeley is a powerful software. It helps the researcher in research work. And to do a new research, Mendeley provides a platform for the researcher to search. And research papers, articles and other documents can be kept in Mendeley. And papers can be shared in private and public groups. You can create a bibliography using Mendeley.

R Rabbit - R Rabbit is a tool. R Rabbit helps the researcher for research articles. R Rabbit uses AI. With the use of R Rabbit, the researcher can reduce the time period. With the help of R Rabbit, it has become easy to search related literature. R Rabbit is a free online platform. R Rabbit presents a list of articles through the database for the researcher.

AI - AI is a tool. With the help of AI, researchers can quickly scan the database of research articles, and identify research papers related to the research topic. With the help of AI tools, machine learning and natural language and technology are used for literature review, data analysis and writing. AI

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plays an important role in a research work. And AI tool is important for data collection. AI provides tools to analyze qualitative data for training and model development.

Conclusion

Research work currently emphasizes digital use. Today's research is the most innovative approach to learning and study. Which is based on both research and innovation. The government provides many programs to encourage new education among students as well as teachers. It also emphasizes the vision of research and innovation in the current higher education system. We have to adopt the challenges of new education. And find answers to these challenges. Integration of technology in the process of teaching and learning is also one of the latest ideas in higher education. According to the National Education Policy 2020, all students have to get permanent access to high-quality education. E-data has been given more importance for research and innovation. It keeps the data in an organized manner and combines and integrates data sets.

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CHAPTER 5
डबल बर्डन' सिंड्रोम: घरेलू और ऑफिस की ज़िम्मेदारियों के बीच फंसी महिलाएँ

नीति खरें[1]
सहायक प्रोफेसर (कला विभाग) , रूंगटा कॉलेज ऑफ साइंस एंड टेक्नोलॉजी

सारांश
डबल बर्डन सिंड्रोम (Double Burden Syndrome) एक सामाजिक और आर्थिक चुनौती है, जिसमें महिलाएँ कार्यस्थल की पेशेवर ज़िम्मेदारियों के साथ.साथ घरेलू कार्यों और पारिवारिक दायित्वों का बोझ भी उठाती हैं। यह दोहरी ज़िम्मेदारी महिलाओं के मानसिक, शारीरिक और भावनात्मक स्वास्थ्य पर प्रतिकूल प्रभाव डालती है, जिससे तनाव, थकान, और करियर में प्रगति की बाधाएँ उत्पन्न होती हैं। पारंपरिक लैंगिक भूमिकाओं, असमान घरेलू श्रम विभाजन, सामाजिक अपेक्षाओं और कार्यस्थलों पर लचीली नीतियों के अभाव के कारण यह समस्या और गंभीर हो जाती है। महिलाओं को अक्सर करियर और परिवार के बीच संतुलन बनाने के लिए व्यक्तिगत इच्छाओं और प्रोफेशनल ग्रोथ से समझौता करना पड़ता है, जिससे उनके आत्मविश्वास और उत्पादकता पर नकारात्मक प्रभाव पड़ता है। इसके समाधान के लिए पुरुषों और महिलाओं के बीच घरेलू ज़िम्मेदारियों का समान विभाजन, कार्यस्थलों पर लचीली नीतियों का कार्यान्वयन, सरकारी और कॉर्पोरेट नीतिगत सुधार, तथा सामाजिक जागरूकता अभियानों की आवश्यकता है। यह समस्या केवल महिलाओं तक सीमित नहीं है, बल्कि यह एक व्यापक सामाजिक मुद्दा है, जिसका समाधान समाज, कार्यस्थल और नीति-निर्माताओं के संयुक्त प्रयासों से ही संभव हो सकता है।

परिचय
डबल बर्डन सिंड्रोम (Double Burden Syndrome) एक ऐसी सामाजिक और आर्थिक वास्तविकता है, जो आधुनिक कार्यरत महिलाओं के जीवन को जटिल बनाती है। यह सिंड्रोम उस स्थिति को दर्शाता है जिसमें महिलाएँ पेशेवर कार्यस्थल पर समान योगदान देने के बावजूद पारिवारिक और घरेलू ज़िम्मेदारियों का बोझ भी उठाती हैं। समाज में पारंपरिक रूप से महिलाओं को परिवार और घरेलू कार्यों की देखभाल करने वाली के रूप में देखा जाता है, जबकि पुरुषों की भूमिका मुख्य रूप से आर्थिक संसाधन जुटाने तक सीमित मानी जाती रही है। हालांकि, औद्योगीकरण, शिक्षा के प्रसार और महिलाओं की बढ़ती आर्थिक भागीदारी के कारण यह धारणा धीरे-धीरे बदल रही है, लेकिन घरेलू श्रम विभाजन में अपेक्षित बदलाव अभी भी पूरी तरह से नहीं हुआ है।

महिलाओं की बढ़ती पेशेवर भागीदारी के बावजूद, उन्हें घर के कामों और पारिवारिक दायित्वों से पूरी तरह मुक्त नहीं किया जाता। कई शोध यह दर्शाते हैं कि पुरुषों की तुलना में महिलाएँ दोगुना समय घरेलू कार्यों में लगाती हैं, भले ही वे पूर्णकालिक नौकरी कर रही हों। इसके अतिरिक्त, बच्चों की परवरिश, बुजुर्गों की देखभाल, भोजन बनाना, सफाई, और अन्य घरेलू कार्यों की ज़िम्मेदारी भी महिलाओं के ऊपर बनी रहती है। इस दोहरे कार्यभार के कारण महिलाओं को अत्यधिक तनाव, थकान और मानसिक दबाव का सामना करना पड़ता है, जिससे उनके स्वास्थ्य और करियर की प्रगति पर नकारात्मक प्रभाव पड़ता है।

कार्यस्थल पर भी महिलाओं को कई प्रकार की चुनौतियों का सामना करना पड़ता है। उनमें से एक प्रमुख चुनौती यह है कि कई कंपनियों और संगठनों में महिलाओं के लिए लचीले कार्य घंटे, मातृत्व अवकाश, पितृत्व अवकाश जैसी सुविधाएँ सीमित होती हैं। इसके अतिरिक्त, महिलाएँ जब करियर और परिवार के बीच संतुलन बनाने का प्रयास करती हैं, तो वे करियर में धीमी गति से प्रगति करती हैं, जिससे उनकी आर्थिक स्वतंत्रता और पेशेवर पहचान पर प्रभाव पड़ता है। साथ

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ही, कार्यस्थल पर लैंगिक भेदभाव और महिलाओं की दोहरी भूमिका को नज़रअंदाज करने की प्रवृत्ति इस समस्या को और जटिल बना देती है।

डबल बर्डन सिंड्रोम सिर्फ व्यक्तिगत स्तर पर महिलाओं को प्रभावित नहीं करता, बल्कि इसका व्यापक सामाजिक और आर्थिक प्रभाव भी पड़ता है। जब महिलाएँ लगातार दोहरे कार्यभार के दबाव में रहती हैं, तो उनके स्वास्थ्य पर प्रतिकूल प्रभाव पड़ता है, जिससे वे कार्यक्षमता खोने लगती हैं। दीर्घकालिक रूप से, यह स्थिति न केवल महिलाओं के करियर बल्कि समग्र उत्पादकता और सामाजिक विकास को भी बाधित कर सकती है। यह समस्या केवल महिला-विशेष मुद्दा नहीं है, बल्कि यह लैंगिक समानता, सामाजिक संरचना और कार्यस्थल की नीतियों से जुड़ा एक व्यापक विषय है, जिसे एक समग्र दृष्टिकोण से हल करने की आवश्यकता है।

इस शोध पत्र में डबल बर्डन सिंड्रोम के विभिन्न पहलुओं पर विस्तार से चर्चा की गई है, जिसमें इसके सामाजिक और मनोवैज्ञानिक प्रभाव, कार्यस्थल पर नीतिगत चुनौतियाँ, घरेलू श्रम विभाजन में असमानता, और इससे निपटने के लिए संभावित समाधान शामिल हैं। समाज, सरकार और कॉर्पोरेट जगत के सहयोग से ही इस समस्या का प्रभावी समाधान खोजा जा सकता है, जिससे महिलाओं को एक समान और संतुलित जीवन जीने का अवसर मिले।

डबल बर्डन सिंड्रोम के कारण (Causes of Double Burden Syndrome)

डबल बर्डन सिंड्रोम का उद्भव कई सामाजिक, सांस्कृतिक, आर्थिक और व्यक्तिगत कारकों के कारण होता है। यह समस्या विशेष रूप से उन महिलाओं को प्रभावित करती है जो न केवल पेशेवर जिम्मेदारियों को निभाती हैं, बल्कि पारिवारिक और घरेलू कार्यों की भी प्रमुख जिम्मेदारी उठाती हैं। इस असमानता को बढ़ावा देने वाले कुछ प्रमुख कारण निम्नलिखित हैं:

1. पारंपरिक सामाजिक संरचना

- पारंपरिक समाजों में लैंगिक भूमिकाओं का निर्धारण पहले से ही किया गया होता हैए जहाँ महिलाओं से घरेलू कार्यों और देखभाल से जुड़ी जिम्मेदारियों को निभाने की अपेक्षा की जाती है।
- भले ही महिलाएँ कार्यरत हों और आर्थिक रूप से स्वतंत्र हों, फिर भी उन्हें घर के कामों और परिवार की देखभाल में अधिक योगदान देना पड़ता है।
- समाज का एक बड़ा वर्ग अब भी इस धारणा को बनाए हुए है कि महिलाओं का प्राथमिक कर्तव्य घर और परिवार को संभालना है।

2. असमान घरेलू श्रम विभाजन

- विभिन्न शोधों से पता चला है कि महिलाएँ पुरुषों की तुलना में घरेलू कार्यों में अधिक समय लगाती हैं, भले ही वे समान रूप से नौकरी कर रही हों।
- खाना बनाना, सफाई करना, बच्चों और बुजुर्गों की देखभाल करना जैसे कार्यों में महिलाओं का योगदान पुरुषों से कहीं अधिक होता है।
- पुरुषों का पारिवारिक जिम्मेदारियों में कम भागीदारी निभाना महिलाओं पर दोहरी ज़िम्मेदारी का भार डालता है।

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3. संस्कृति और परंपराएँ

- पारंपरिक और रूढ़िवादी समाजों में महिलाओं की घरेलू भूमिका को अनिवार्य माना जाता है, जिससे उनकी स्वतंत्रता और करियर विकास बाधित हो सकता है।
- कुछ समुदायों में यह मान्यता है कि महिलाएँ ही घर की देखभाल के लिए ज़िम्मेदार होती हैं, और इस सोच में परिवर्तन बहुत धीरे-धीरे हो रहा है।
- महिलाएँ अक्सर सामाजिक दबाव के कारण अपने करियर की संभावनाओं को सीमित कर देती हैं, ताकि वे पारिवारिक और सामाजिक अपेक्षाओं को पूरा कर सकें।

4. काम और जीवन का असंतुलन (Work-Life Imbalance)

- आधुनिक कार्यस्थलों में प्रतिस्पर्धा और कार्यभार अधिक होने के कारण महिलाओं के लिए नौकरी और पारिवारिक जीवन में संतुलन बनाना चुनौतीपूर्ण हो जाता है।
- लचीले कार्य समय (Flexible Work Hours) की कमी, लंबी कार्य अवधि और घर से काम (Work from Home) के अवसरों की सीमित उपलब्धता इस असंतुलन को और बढ़ाते हैं।
- कई बार कार्यस्थल पर महिलाओं से यह अपेक्षा की जाती है कि वे पुरुषों के समान या अधिक मेहनत करें, लेकिन घर पर उन्हें कोई अतिरिक्त सहायता नहीं मिलतीए जिससे उन पर मानसिक और शारीरिक दबाव बढ़ता है।

5. आर्थिक निर्भरता और सीमित समर्थन प्रणाली

- कई महिलाएँ आर्थिक रूप से आत्मनिर्भर नहीं होतींए जिससे वे पारिवारिक निर्णयों में पूर्ण स्वतंत्रता नहीं रखतीं और घर की ज़िम्मेदारियों से मुक्त होने के लिए किसी बाहरी सहायता की मांग नहीं कर पातीं।
- कम आमदनी वाली महिलाओं के लिए घरेलू सहायक (Maid) या डे-केयर सेवाएँ (Day-Care Services) लेना आर्थिक रूप से कठिन होता है, जिससे वे सभी कार्यों का भार अकेले ही उठाने को मजबूर होती हैं।
- संयुक्त परिवारों में भी घरेलू कार्यों की ज़िम्मेदारी अक्सर महिलाओं पर ही अधिक होती है, और परिवार के अन्य सदस्यों से अपेक्षित सहायता नहीं मिलती।

6. संस्थागत और नीतिगत कमियाँ

- कई देशों में कार्यस्थल पर पर्याप्त मातृत्व अवकाशए चाइल्डकैअर सुविधाएँ और लैंगिक समानता को प्रोत्साहित करने वाली नीतियों का अभाव है।
- महिलाओं को अक्सर करियर के मामले में कमतर आँका जाता है, जिससे उन्हें प्रमोशन, उच्च पदों और बेहतर वेतन के अवसरों में असमानता का सामना करना पड़ता है।
- सरकारों और संगठनों द्वारा महिलाओं के कार्य-जीवन संतुलन को सुधारने के लिए प्रभावी नीतियाँ नहीं बनाई गई हैंए जिससे यह समस्या बनी रहती है।

महिलाओं पर प्रभाव (Impact on Women)

डबल बर्डन सिंड्रोम महिलाओं के शारीरिक, मानसिक, सामाजिक और आर्थिक जीवन पर गंभीर प्रभाव डालता है। घरेलू और पेशेवर जीवन के बीच लगातार संतुलन बनाने की कोशिश महिलाओं को कई तरह की चुनौतियों का सामना करने पर मजबूर करती है। इस खंड में इस समस्या के प्रमुख प्रभावों को विस्तार से समझाया गया है।

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1. शारीरिक और मानसिक तनाव (Physical and Mental Stress)

- **अत्यधिक काम का दबाव** – नौकरी और घरेलू कार्यों के दोहरे बोझ से महिलाओं पर निरंतर तनाव बना रहता है।
- **मानसिक स्वास्थ्य पर प्रभाव** – तनाव, चिंता (Anxiety), और डिप्रेशन (Depression) जैसी मानसिक समस्याएँ उत्पन्न हो सकती हैं।
- **भावनात्मक थकान** – हर समय काम और ज़िम्मेदारियों से घिरे रहने के कारण महिलाएँ स्वयं के लिए समय नहीं निकाल पातीं, जिससे वे भावनात्मक रूप से थक जाती हैं।
- **बर्नआउट (Burnout) का खतरा** – लंबे समय तक संतुलन बनाए रखने की कोशिश से शारीरिक और मानसिक ऊर्जा क्षीण होने लगती है, जिससे वे थकान और निराशा महसूस करती हैं।

2. करियर ग्रोथ में बाधा (Hindrance in Career Growth)

- **उन्नति के अवसरों में कमी** – महिलाएँ पारिवारिक ज़िम्मेदारियों के कारण करियर पर पूरी तरह ध्यान नहीं दे पातीं, जिससे उन्हें प्रमोशन और उच्च पदों पर पहुँचने में कठिनाई होती है।
- **कम वेतन और अवसरों में असमानता** – कई कंपनियों में यह धारणा बनी हुई है कि महिलाएँ घरेलू ज़िम्मेदारियों के कारण ज़्यादा समय नहीं दे सकतीं, जिससे उन्हें पुरुषों की तुलना में कम वेतन और सीमित अवसर मिलते हैं।
- **स्किल डेवलपमेंट में बाधा** – घरेलू कार्यों में उलझी रहने के कारण महिलाएँ नई स्किल्स सीखने या प्रोफेशनल ट्रेनिंग में भाग लेने के लिए समय नहीं निकाल पातीं।
- **करियर छोड़ने की संभावना** – कई बार महिलाएँ पारिवारिक दबाव और कार्य-जीवन असंतुलन के कारण नौकरी छोड़ने या पार्ट-टाइम काम करने को मजबूर हो जाती हैं, जिससे उनका करियर □□□□□□□□ □□□□ □□□

3. स्वास्थ्य समस्याएँ (Health Issues)

- **शारीरिक थकान और ऊर्जा की कमी** – लगातार काम करने से शरीर को पर्याप्त आराम नहीं मिल पाता, जिससे कमजोरी और थकान बनी रहती है।
- **नींद की कमी (Sleep Deprivation)** – घरेलू और पेशेवर कार्यों को पूरा करने के लिए महिलाएँ अक्सर अपनी नींद का त्याग करती हैं, जिससे उनकी कार्यक्षमता और स्वास्थ्य प्रभावित होता है।
- **हृदय संबंधी रोग (Cardiovascular Diseases)** – तनाव, अनियमित दिनचर्या और थकान के कारण हाई ब्लड प्रेशर, हृदय रोग और अन्य गंभीर बीमारियों का खतरा बढ़ जाता है।
- **माइग्रेन और सिरदर्द (Migraine & Headaches)** – अत्यधिक मानसिक और शारीरिक दबाव के कारण कई महिलाओं को माइग्रेन और लगातार सिरदर्द की समस्या होने लगती है।
- **पोषण की कमी (Nutritional Deficiencies)** – समय की कमी के कारण कई महिलाएँ अपने खान-पान पर ध्यान नहीं दे पातीं, जिससे आयरन, कैल्शियम और अन्य आवश्यक पोषक तत्वों की कमी हो सकती है।

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4. सामाजिक जीवन पर असर (Impact on Social Life)

- **सामाजिक मेलजोल में कमी** – महिलाओं के पास अपने दोस्तों, रिश्तेदारों और सामाजिक गतिविधियों के लिए पर्याप्त समय नहीं होता, जिससे वे सामाजिक रूप से अलग-थलग महसूस करने लगती हैं।
- **व्यक्तिगत रुचियों का अभाव** – घरेलू और पेशेवर जिम्मेदारियों के बीच महिलाएँ अपनी रुचियों और शौक को पूरा करने के लिए समय नहीं निकाल पातीं, जिससे उनका व्यक्तिगत विकास बाधित होता है।
- **पारिवारिक संबंधों पर प्रभाव** – लगातार काम और तनाव के कारण पति-पत्नी के रिश्ते, बच्चों के साथ समय बिताने की क्षमता और पारिवारिक सामंजस्य पर नकारात्मक प्रभाव पड़ सकता है।
- **स्वतंत्रता और आत्मनिर्भरता में कमी** – कई बार महिलाएँ केवल घरेलू भूमिकाओं तक सीमित रह जाती हैं, जिससे वे स्वतंत्र रूप से निर्णय लेने और आत्मनिर्भर बनने में कठिनाई महसूस करती हैं।

1. डबल बर्डन सिंड्रोम: 10 महिलाओं की केस स्टडी

डबल बर्डन सिंड्रोम महिलाओं के जीवन को गहराई से प्रभावित करता है। विशेष रूप से उन महिलाओं को जो घरेलू जिम्मेदारियों और पेशेवर जीवन के बीच संतुलन बनाने का प्रयास कर रही हैं। इस अध्ययन में 10 महिलाओं के केस स्टडी को शामिल किया गया है। जो विभिन्न सामाजिक और आर्थिक पृष्ठभूमियों से आती हैं और इस समस्या का सामना कर रही हैं। इसके लिए एक विशेष प्रश्नावली तैयार की गई, जिसमें उनकी व्यक्तिगत जानकारी, कार्य और घरेलू जीवन का संतुलन, मानसिक और शारीरिक प्रभाव, और संभावित समाधान पर ध्यान केंद्रित किया गया।

1. अंजलि वर्मा (32 वर्ष, बैंक कर्मचारी, विवाहित, दो बच्चे)

- अंजलि एक सरकारी बैंक में कार्यरत हैं और उनके दो छोटे बच्चे हैं। वे रोज़ाना 9 घंटे बैंक में और 4-5 घंटे घर के कामों में लगाती हैं। पति और सास-ससुर घरेलू कार्यों में मदद नहीं करते, जिससे उन पर भारी दबाव रहता है। उन्हें माइग्रेन और नींद की कमी की समस्या है। समाधान: उन्होंने एक घरेलू हेल्पर रखी है, जिससे कुछ राहत मिली है।

2. प्रियंका मेहता (28 वर्ष, सॉफ्टवेयर इंजीनियर, विवाहित, कोई संतान नहीं)

- प्रियंका आईटी सेक्टर में हैं और वर्क-फ्रॉम-होम करती हैं। वे 10-12 घंटे लैपटॉप पर काम करती हैं और साथ में घर की सफाई और खाना भी बनाती हैं। पति मदद करने की कोशिश करते हैं। लेकिन पारिवारिक दबाव के कारण वे अकेले ही ज़्यादातर काम करती हैं। उन्हें गर्दन और पीठ दर्द की समस्या हो गई है। समाधान: उन्होंने अपने ऑफिस से फ्लेक्सिबल वर्किंग आवर्स की सुविधा ली है।

3. रेखा देवी (40 वर्ष, स्कूल टीचर, विवाहित, तीन बच्चे)

- रेखा एक सरकारी स्कूल में पढ़ाती हैं और सुबह 7 बजे से दोपहर 2 बजे तक स्कूल में रहती हैं। स्कूल से लौटने के बाद उन्हें पूरा घर संभालना पड़ता है। पति ऑफिस से देर रात लौटते हैं और घरेलू कार्यों में मदद नहीं करते। उनके स्वास्थ्य पर गहरा प्रभाव पड़ा है, उन्हें हाई ब्लड प्रेशर हो गया है। समाधान: उन्होंने परिवार से सहयोग मांगा और बच्चों को छोटे-छोटे काम सौंपे।

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4. शालिनी मिश्रा (30 वर्ष, डॉक्टर, विवाहित, एक बच्चा)

- शालिनी एक निजी अस्पताल में डॉक्टर हैं और 12 घंटे ड्यूटी पर रहती हैं। वे थकान और मानसिक तनाव महसूस करती हैं। ससुराल में महिलाओं से ज़्यादा काम की अपेक्षा होने के कारण उनका मानसिक दबाव बढ़ गया है। समाधानरू उन्होंने एक काउंसलर से संपर्क किया और सप्ताह में एक दिन पूरी तरह आराम करने का नियम बनाया।

5. नेहा कश्यप (25 वर्ष, बिजनेस ओनर, अविवाहित)

- नेहा का एक ऑनलाइन बिजनेस है, जिसमें उन्हें 14-15 घंटे काम करना पड़ता है। वे घर के भी सभी काम करती हैं क्योंकि परिवार में अन्य लोग नौकरी करते हैं। उनके पास कोई निजी समय नहीं बचता। समाधान: उन्होंने कुछ कामों के लिए असिस्टेंट रख लिया है और टाइम-मैनेजमेंट तकनीकों का उपयोग करने लगी हैं।

6. कविता तिवारी (35 वर्ष, सरकारी कर्मचारी, विवाहित, एक बच्चा)

- कविता के ससुराल में घरेलू कामों का सारा भार महिलाओं पर है। ऑफिस के काम और घर के कामों में उलझकर उन्हें शारीरिक थकान महसूस होती है। उन्होंने अपने करियर में आगे बढ़ने के कई मौके गंवा दिए। समाधान: उन्होंने ऑफिस में ट्रांसफर के लिए आवेदन किया, जिससे वे घर के पास रह सकें।

7. सुमन यादव (29 वर्ष, नर्स, विवाहित, दो बच्चे)

- सुमन की नौकरी में शिफ्ट बदलती रहती है, जिससे उनका रूटीन असंतुलित रहता है। घर का सारा काम भी उन्हें ही करना पड़ता है। उन्हें घबराहट और तनाव की शिकायत रहने लगी है। समाधान: उन्होंने अपने पति से मदद मांगी और वीकेंड्स पर घर के कामों का बंटवारा किया।

8. गीता शर्मा (38 वर्ष, गृहिणी, विवाहित, तीन बच्चे)

- गीता कोई नौकरी नहीं करतींए लेकिन उनके ऊपर पूरा घरेलू भार है। उन्हें कोई मानसिक या शारीरिक आराम नहीं मिलता, जिससे वे निराशा महसूस करती हैं। समाधान: उन्होंने पास के एक स्वयं सहायता समूह (Self-Help Group) में शामिल होकर आर्थिक स्वतंत्रता की दिशा में कदम बढ़ाया।

9. अनु चौहान (27 वर्ष, फैशन डिजाइनर, अविवाहित)

- अनु का खुद का बुटीक है और वे ग्राहकों से मिलने के लिए अक्सर बाहर रहती हैं। घरेलू कामों की वजह से वे अपने व्यवसाय पर पूरा ध्यान नहीं दे पातीं। समाधान: उन्होंने एक सहायक रखा और परिवार से मदद लेना शुरू किया।

10. सीमा राठी (34 वर्ष, पत्रकार, विवाहित, एक बच्चा)

- पत्रकार होने के कारण सीमा को अनिश्चित कार्य.घंटों का सामना करना पड़ता है। उनके ससुराल में उनकी नौकरी को प्राथमिकता नहीं दी जाती। उन्हें आत्मग्लानि होती है कि वे अपने बच्चे को पर्याप्त समय नहीं

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दे पातीं। समाधान: उन्होंने कार्यस्थल पर डे.केयर सुविधा का लाभ उठाया और समय प्रबंधन पर ध्यान दिया।

2. केस स्टडी के निष्कर्ष

इस केस स्टडी के निष्कर्षों से यह स्पष्ट होता है कि डबल बर्डन सिंड्रोम महिलाओं के मानसिकए शारीरिक और सामाजिक जीवन पर गहरा प्रभाव डालता है। अध्ययन में शामिल महिलाओं ने बताया कि वे घरेलू और पेशेवर जीवन के बीच संतुलन बनाने के प्रयास में अत्यधिक तनाव, थकान, और स्वास्थ्य संबंधी समस्याओं जैसे नींद की कमी, हाई ब्लड प्रेशर, और माइग्रेन से जूझ रही हैं। अधिकांश महिलाओं को घरेलू कार्यों में पुरुषों या परिवार के अन्य सदस्यों से बहुत कम सहयोग मिलता है, जिससे उनका कार्यभार और बढ़ जाता है। कई महिलाओं ने स्वीकार किया कि उनके करियर की प्रगति इस दोहरे भार के कारण बाधित हुई है, क्योंकि वे अतिरिक्त जिम्मेदारियों के कारण नई पेशेवर चुनौतियों को स्वीकार नहीं कर पातीं। इसके अलावाए महिलाओं का सामाजिक जीवन भी प्रभावित होता है, क्योंकि उनके पास व्यक्तिगत रुचियों और सामाजिक मेलजोल के लिए पर्याप्त समय नहीं बचता। इसके अलावाए अध्ययन में यह भी पाया गया कि सामाजिक और सांस्कृतिक अपेक्षाएँ महिलाओं की इस समस्या को और जटिल बनाती हैं। कई महिलाओं ने महसूस किया कि परिवार और समाज उन्हें घरेलू कार्यों की प्राथमिक जिम्मेदारी निभाने के लिए बाध्य करता है, भले ही वे पूर्णकालिक नौकरी कर रही हों। कुछ महिलाओं ने बताया कि उन्हें भावनात्मक और मानसिक तनाव का सामना करना पड़ता है, क्योंकि वे खुद को अपने परिवार और करियर दोनों के लिए पर्याप्त नहीं मान पातीं। हालांकि, कुछ महिलाओं ने समाधान के रूप में घरेलू हेल्पर रखनाए कार्यस्थल पर फ्लेक्सिबल वर्किंग ऑवर्स की सुविधा लेना, और परिवार से सहायता माँगना जैसे उपाय अपनाएए जिससे उनकी स्थिति में आंशिक सुधार हुआ। इसके बावजूदए अधिकांश महिलाओं ने माना कि जब तक समाज में लैंगिक समानता की सोच विकसित नहीं होगी और कार्यस्थलों पर लचीली नीतियाँ लागू नहीं की जाएँगी, तब तक यह समस्या बनी रहेगी। निष्कर्षतःए डबल बर्डन सिंड्रोम केवल महिलाओं की व्यक्तिगत चुनौती नहींए बल्कि एक सामाजिक समस्या है, जिसे दूर करने के लिए परिवार, कार्यस्थल, और नीति निर्माताओं को एक साथ मिलकर प्रयास करने होंगे।

3. अध्ययन का परिणाम

इस अध्ययन का परिणाम दर्शाता है कि डबल बर्डन सिंड्रोम महिलाओं के मानसिकए शारीरिक और पेशेवर जीवन को प्रभावित करता है। घरेलू और कार्यस्थल की जिम्मेदारियों का असमान वितरण तनाव, थकान और करियर में रुकावटें पैदा करता है। सामाजिक अपेक्षाएँ और परिवार का सीमित सहयोग इस समस्या को और बढ़ाते हैं। हालांकि कुछ महिलाओं ने कार्यस्थल की लचीली नीतियों और घरेलू मदद से आंशिक राहत पाई, लेकिन यह स्थायी समाधान नहीं है। जब तक समाज में लैंगिक समानता को बढ़ावा नहीं दिया जाता और नीतिगत सुधार लागू नहीं होते, तब तक यह समस्या बनी रहेगी।

- **तनाव स्तर और कार्यभार के बीच संबंध**

यह ग्राफ दर्शाता है कि घरेलू और पेशेवर कार्यभार बढ़ने के साथ महिलाओं में तनाव का स्तर कैसे बढ़ता है। **X-अक्ष:** कुल दैनिक कार्यभार Workload (घंटों में) **Y-अक्ष:** तनाव स्तर Stress Level (1 से 10 के पैमाने पर) 6-8 घंटे के कार्यभार पर तनाव स्तर मध्यम (4-5) रहता है। 9-12 घंटे के कार्यभार पर तनाव स्तर उच्च ;7.8द्ध हो जाता है। 12 घंटे का कार्यभार होने पर तनाव अत्यधिक (9-10) दर्ज किया गया। इससे स्पष्ट होता है कि जैसे.जैसे महिलाओं पर घरेलू और पेशेवर ज़िम्मेदारियाँ बढ़ती हैंए वैसे.वैसे उनके मानसिक तनाव का स्तर भी बढ़ता जाता है।

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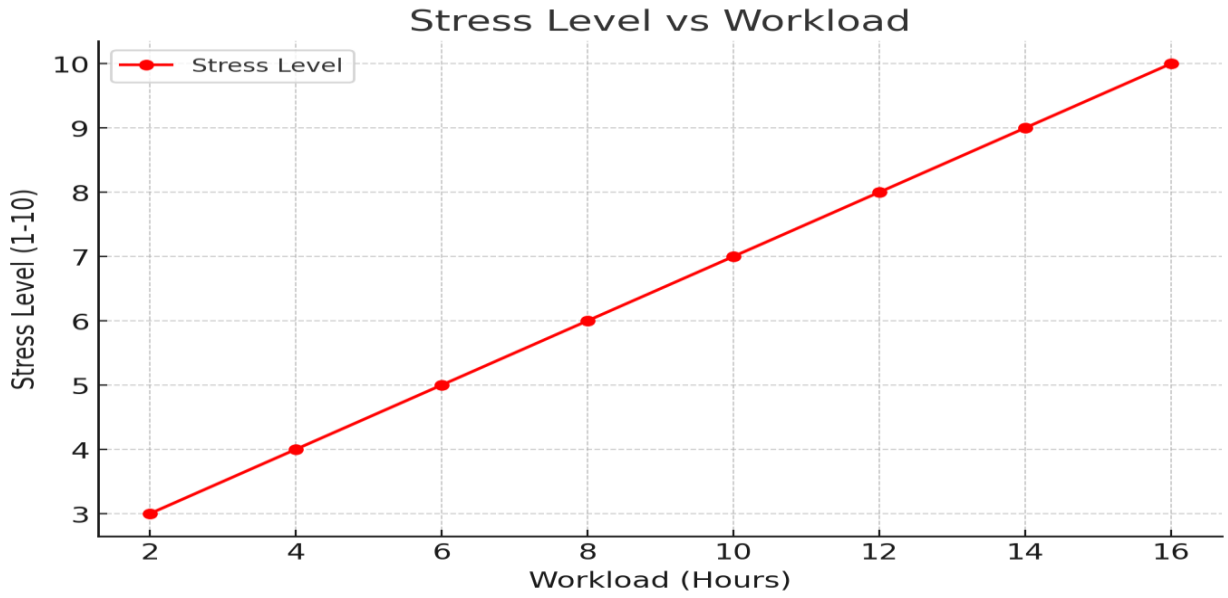
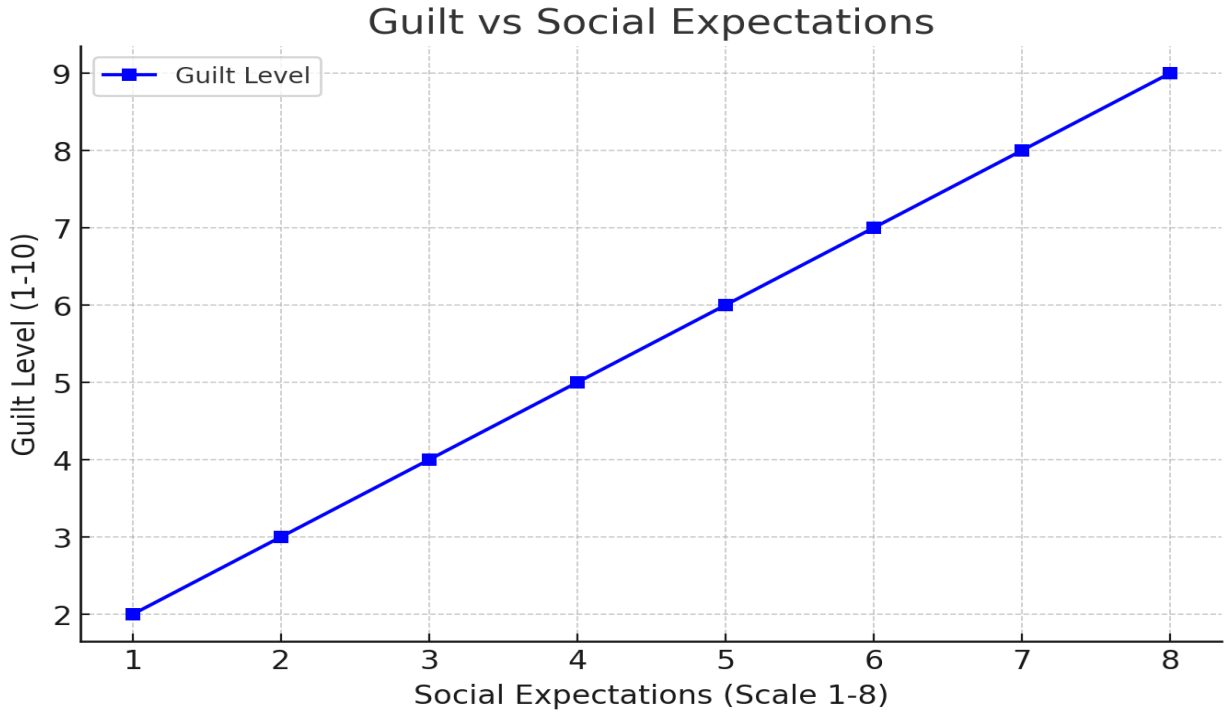


- **आत्मग्लानि बनाम सामाजिक अपेक्षाएँ**

यह ग्राफ महिलाओं में आत्मग्लानि ;ळनपसजद्ध और समाज द्वारा उन पर डाली गई अपेक्षाओं (Expectations) के बीच संबंध को दिखाता है। **X-अक्ष:** सामाजिक अपेक्षाओं का स्तर (1 से 10) **Y-अक्ष:** आत्मग्लानि का स्तर (1 से 10) जिन महिलाओं को परिवार और समाज से कम अपेक्षाएँ झेलनी पड़ीं, उनमें आत्मग्लानि का स्तर 2-4 के बीच था। मध्यम अपेक्षाओं वाली महिलाओं में आत्मग्लानि का स्तर 5-7 तक बढ़ गया। अत्यधिक सामाजिक अपेक्षाओं का सामना करने वाली महिलाओं में आत्मग्लानि का स्तर 8-10 तक पहुँच गया। यह ग्राफ दिखाता है कि जब समाज महिलाओं से घरेलू कार्यों और पेशेवर जीवन दोनों में पूर्ण समर्पण की उम्मीद करता हैए तो वे खुद को कभी पर्याप्त नहीं मानतीं, जिससे उनमें अपराधबोध और मानसिक दबाव बढ़ता है।



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4. निष्कर्ष

यह अध्ययन दर्शाता है कि डबल बर्डन सिंड्रोम महिलाओं के मानसिक, शारीरिक और सामाजिक जीवन पर गहरा प्रभाव डालता है। घरेलू और पेशेवर ज़िम्मेदारियों के असमान विभाजन के कारण महिलाओं को अत्यधिक तनाव, थकान, और आत्मग्लानि का सामना करना पड़ता है। सामाजिक अपेक्षाएँ और परिवार से सीमित सहयोग इस समस्या को और जटिल बना देते हैं। अध्ययन से यह भी स्पष्ट हुआ कि जैसे-जैसे महिलाओं पर कार्यभार बढ़ता है, उनका तनाव स्तर बढ़ता जाता है, और समाज की अपेक्षाओं के चलते उनमें आत्मग्लानि की भावना भी अधिक हो जाती है। हालाँकि, कुछ महिलाओं ने कार्यस्थल की लचीली नीतियों, घरेलू मदद, और परिवार के समर्थन से आंशिक राहत पाई, लेकिन यह समस्या का स्थायी समाधान नहीं है। जब तक समाज में लैंगिक समानता को बढ़ावा नहीं दिया जाता और घर तथा कार्यस्थल दोनों में जिम्मेदारियों का संतुलित वितरण नहीं किया जाता, तब तक यह समस्या बनी रहेगी। इस स्थिति में सुधार लाने के लिए न केवल परिवारों को बल्कि नियोक्ताओं और नीति-निर्माताओं को भी ठोस कदम उठाने की आवश्यकता है।

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CHAPTER 6
Implementation of NEP 2020 in Chhattisgarh: opportunities and challenges

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Introduction

The National Education Policy (NEP) 2020 aims to bring about a significant shift in the education sector by establishing a system grounded in Indian values. Its goal is to help transform India (Bharat) into a fair, dynamic, and knowledgeable society by ensuring quality education for everyone, ultimately positioning the country as a global leader in knowledge. The policy is built on five core principles: Access, Equity, Quality, Affordability, and Accountability. It is designed to equip the younger generation to face both current and future challenges at national and international levels.

The National Education Policy (NEP) 2020 emphasizes that school education should not only build cognitive abilities—such as foundational literacy and numeracy, and advanced skills like critical thinking and problem-solving—but also foster social and emotional abilities, often known as soft skills. These include cultural sensitivity, empathy, perseverance, teamwork, leadership, and communication. The NEP aims to make pre-primary education accessible to all and places strong emphasis on achieving basic literacy and numeracy for all children by 2025. It proposes a wide range of reforms across school education to improve quality, such as a new 5+3+3+4 curricular structure for children aged 3 to 18 years, changes to exams and assessments, better teacher training, and revamping the regulatory system. The policy advocates for increased public investment, integration of technology, and greater attention to vocational and adult education. It also suggests reducing curriculum content to essential topics to allow for more holistic and analytical learning.

The National Education Policy (NEP) 2020 outlines several key recommendations for improving higher education in India. These include promoting multidisciplinary and holistic learning, granting more autonomy to institutions, encouraging high-quality research and ensuring continuous professional development for educators. It also emphasizes the use of technology, the internationalization of higher education, and the restructuring of governance and regulatory systems. The policy supports the adoption of multidisciplinary curriculum, blended teaching methods, reliable assessment practices, and the availability of educational content in Indian languages. NEP 2020 aims to transform the education system and help position India as a global center for skilled talent during the 'Amrit Kaal,' the 25-year journey toward becoming a developed nation by 2047. Achieving this vision will require coordinated efforts from the central and state governments, union territories, higher education institutions, regulatory bodies, and all relevant stakeholders.

Objectives of NEP 2020:

The National Education Policy (NEP) 2020 presents an all-encompassing plan to transform India's educational structure, focusing on creating a more well-rounded, adaptable, and interdisciplinary

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approach that meets the demands of the 21st century. Its goal is to equip learners to face current and future challenges while preserving the country's cultural heritage and core values.

1.Transformative Shift:

The NEP 2020 seeks to revolutionize India's education system by adapting it to 21st-century requirements and encouraging comprehensive, interdisciplinary learning.

2.Global Knowledge Superpower:

The policy aspires to position India as a leading global center of knowledge by ensuring accessible, high-quality education for everyone.

3. Sustainable Development:

The National Education Policy (NEP) 2020 aims to support the creation of a fair and sustainable knowledge-based society by ensuring access to high-quality education for everyone.

4. Holistic Development:

It highlights the need to nurture a well-rounded development by focusing not just on intellectual abilities, but also on emotional and social skills such as creativity, critical thinking, and the ability to solve problems.

5. Emphasis on Indian Ethos:

The policy is deeply grounded in the cultural traditions and core values of India.

Features of NEP 2020

1. Revised Curriculum and Teaching Framework:

The NEP 2020 brings in a fresh educational format of 5+3+3+4, moving away from the traditional 10+2 model.

2. Focus on Basic Literacy and Numeracy:

The policy highlights the critical need to build essential skills such as reading, writing, and basic mathematics.

3. Promotion of Multilingualism:

The NEP 2020 advocates for using one's native language or local language as the primary medium of instruction, especially during the foundational years.

4. Assessment Reforms:

The policy establishes a new National Assessment Centre, PARAKH, and seeks to introduce more flexibility into board examinations.

5. Inclusivity and Equity:

The NEP 2020 prioritizes ensuring equal and inclusive education, particularly for marginalized and economically disadvantaged communities.

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6. Early Childhood Care and Education:

The policy highlights the significance of providing high-quality care and education for children between the ages of 3 and 6.

Implementation of NEP 2020 in Chhattisgarh:-The Government of Chhattisgarh is proactively adopting the National Education Policy (NEP) 2020, with a focus on key areas such as the 5+3+3+4 curricular structure, early childhood care and education, and encouraging instruction in the local language. Major efforts include creating state-specific curriculum frameworks, conducting orientation programs for stakeholders, and developing curricula that align with the goals of NEP 2020. Additionally, the state is working on improving foundational literacy and numeracy, as well as updating vocational education.

Here's a closer look at how Chhattisgarh is implementing the policy:

1.Curriculum Development:

The state is creating State Curriculum Frameworks (SCF-SE) for school education, ensuring that the curricula are in line with the objectives of NEP 2020.

2. Orientation Programs:

Orientation programs at the state level are being organized for different stakeholders, such as teachers and administrators, to facilitate the effective implementation of the policy.

3. Foundational Literacy and Numeracy:

Chhattisgarh is prioritizing the goal of ensuring that every child achieves foundational literacy and numeracy by the end of Grade 3, in line with the NIPUN Bharat initiative.

4. Local Language Medium of Instruction:

The state is actively working to implement NEP 2020's suggestion of using the mother tongue or local language as the primary medium of instruction, especially in remote tribal regions, up to at least Grade 5.

5. 5+3+3+4 Structure:

The revised academic structure is being put into practice, with students spending five years in the foundational stage, three years in the preparatory stage, three years in the middle stage, and four years in the secondary stage.

6. Teacher Education:

The state is concentrating on improving teacher education, which includes ongoing professional development (CPD) for educators, and is considering the integration of teacher training institutions.

7. Curriculum Orientation Programs:

You can find documents and presentations concerning state-level curriculum orientation programs for stakeholders on the SCERT website.

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8. NIEPA's Role:

The National Institute of Educational Planning and Administration (NIEPA) plays a key role in supporting the implementation of NEP 2020, with its faculty providing expertise and working on strategies across different areas.

Chhattisgarh is actively working towards the implementation of NEP 2020, with an emphasis on improving school education, teacher training, and curriculum design. The state is dedicated to providing quality education to all children and ensuring the successful realization of the policy's objectives.

Opportunities: -

The National Education Policy (NEP) 2020 is an all-encompassing framework designed to reform India's education system. It offers numerous opportunities for students, teachers, and educational institutions.

1. promotion of holistic and multidisciplinary education, allowing students to explore a diverse range of subjects and acquire a variety of skills. This approach aims to shape well-rounded individuals, equipping them to tackle the multifaceted challenges of the 21st century.

2. Skill development: NEP 2020 places a strong focus on enhancing skills like critical thinking, problem-solving, creativity, and communication. This approach aims to make students more employable and better prepared for success in a fast-evolving world.

3. Flexibility and choice: NEP 2020 provides students with increased flexibility and options regarding what, how, and when they learn. This flexibility allows them to customize their education to suit their personal interests and needs.

4. Technology integration: NEP 2020 acknowledges the vital role of technology in education and advocates for its incorporation at all educational levels. This will enable both students and teachers to stay connected and engage in innovative learning experiences.

5. Quality improvement: NEP 2020 seeks to enhance the overall quality of education in India by establishing new standards, monitoring systems, and accreditation processes. This will ensure that educational institutions deliver high-quality education and provide students with the best possible learning opportunities.

Challenges: -

The National Education Policy 2020 (NEP-2020) is an extensive framework designed to revolutionize India's education system. Although the policy brings many beneficial changes, it also presents various challenges that must be tackled. Some of the key challenges of NEP-2020 include:

1. Implementation: A major challenge of NEP-2020 is its execution, as the policy spans numerous areas and demands substantial investment and infrastructure. Successful implementation will require collaboration among all relevant stakeholders, such as central and state governments, educational institutions, and the private sector.

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2. Funding: The successful execution of NEP-2020 demands considerable financial resources, but the policy document does not provide specific guidelines on how the funding will be secured. While it mentions the creation of the National Research Foundation, the specifics of its funding remain unclear.

3. Language policy and teachers training:-The NEP-2020 introduces a three-language formula, which has generated debate in certain states. Critics worry that it might enforce a specific language, potentially diminishing the country's linguistic diversity. Additionally, the policy highlights the importance of teacher training and development, but challenges exist in its implementation. The current teacher education system must be overhauled to align with the evolving demands of the education sector.

4. Assessment system:-The policy introduces a new assessment system aimed at fostering the holistic development of students. However, there are concerns that implementing this system could be difficult, particularly in rural areas with limited resources.

5. Inclusivity:-Regarding inclusivity, the policy seeks to make education accessible to everyone, but there are significant challenges in achieving this due to various inequalities in the current education system, such as gender, socio-economic, and regional disparities. 6. Involvement of private sector:-The policy also encourages greater private sector involvement in education, but some worry this could result in the commercialization of education, exacerbating existing inequalities.

Conclusion: -

In summary, the NEP 2020 offers substantial opportunities to reform the education system in India and Chhattisgarh, though its effective execution will necessitate overcoming multiple obstacles. The policy highlights several issues within the Indian education system, and adopting its strategies could help tackle these problems, fostering a more inclusive and well-rounded approach to education. Overcoming these challenges will be essential for the successful implementation of NEP 2020 and for realizing the goal of transforming the education system in Chhattisgarh.

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CHAPTER 7
MODELING AND ANALYSIS OF SIX PHASE PERMANENT MAGNET SYNCHRONOUS MOTOR DRIVE

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Introduction

Three-phase synchronous motors comprising of electrically excited rotor windings which carries D.C. current are equipped with armature arising as a result of stator windings. But such an arrangement has many disadvantages such as reliability issues, less fault tolerance etc. However, these issues can be addressed by the use of permanent magnets in place of electrically excited field winding. This arrangement is of special significance because permanent magnets have many advantages which include elimination of brushes, slip-rings and rotor copper losses in the field windings thus resulting in higher efficiency and rapid cooling. So, the search of fault tolerant and more reliable drive systems with higher degrees of freedom are the need of the hour. This chronology can be understood by the fact that, DC motor drive and induction motor drive have slowly given way to three phase permanent magnet synchronous motor, which in turn has paved the way for multi-phase permanent synchronous motor. This work is a step in this direction, wherein solutions to a multiphase drive system have been generated without creating the scope for additional risks and at the same time ensuring high performance. This chapter deals with the designing of a closed loop control of six – phase PMSM drive by making use of modern control techniques. The need for generation of such a closed loop system arises due to the fact that, it is a daunting task to observe and simultaneously control huge amount of variables in addition to normal input voltages and currents. But this concept of automation of the control of drive system, needs to be done in terms of a measurable as well as observable output, because then only the automation can prove its adaptability as well as reliability. The output parameters which have been chosen are speed, torque and six-phase currents. To generalize the automation process, a mathematical model has been developed for the six-phase PMSM, which has the ability to account for variability of the factors involved. This mathematical model forms the basis of the complete drive system, which is then designed and includes a speed controller, pulse-width modulation (PMW) inverter etc. Finally a closed loop vector control scheme of six-phase PMSM drive has been developed that takes into account different controllers and two pulse width modulated inverters. This complete automated closed-loop system has been developed on the basis of simulation in MATLAB/SIMULINK environment under different operating conditions. The various results obtained from the simulink model under various operating conditions and a wide range of speed is analyzed. Analysis shows satisfactory operation of the drive system.

Emergence of Six-Phase Permanent Magnet Synchronous Motor:-

- PMSM have generated a lot of attraction as well as interest in the recent years because of their widespread and almost single handed utility in the industrial drive application

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- In the synchronous machine if rotor winding is replaced by a permanent magnet this leads to simplicity in structural complexity and reduced copper loss as there are no current circuits in the rotor.
- This new structured synchronous motors are known as permanent magnet synchronous motors (PMSM).

PMSM have a wide application ranging from:

Compressors designed for air conditioner & refrigerator (AC), Washing machines equipped with direct-drive, Automotive electrical power steering, Hybrid vehicle, Ship propulsion, Tools used in machining, Control of Traction

Permanent Magnet Material:

In recent times Aluminum Nickel and Cobalt alloys (ALNICO), Strontium Ferrite or Barium Ferrite (Ferrite), Samarium Cobalt (First generation rare earth magnet) (SmCo) and Neodymium Iron-Boron (Second generation rare earth magnet) (NdFeB) have proved their right in making permanent magnets

Superiority of PMSM over Other Motors (Why PMSM?)

Permanent Magnet Synchronous Motors (PMSMs) offer several advantages over other motor types, primarily due to their use of permanent magnets in the rotor. These advantages include Less noise**,** Spark less**,** Longer life**,** Higher speed range**,** Better harmonic reduction**,** Compact size**,** Better cooling**,** Higher efficiency **,** Low maintenance**,** Simpler controller action**,** Higher power factor**,** High torque/inertia ratio.

Why Six-Phase?

For a given motor output power, multiphase variable speed drive reduces the stator current per phase, This offers an improved reliability. Pulsating torques produced by time harmonic components in the excitation waveform is reduced by Multiphase machines, Fault tolerant drives, Higher degree of freedom.

Classification of PMSM is done on the basis of :

- Rotor construction
- Stator winding
- Magnetic flux orientation
- Number of phase

Rotor Construction

- Based on the rotor construction, PMSM can be either surface mounted permanent magnet synchronous motors (SPMSM) or interior mounted permanent magnet synchronous motors (IPMSM).

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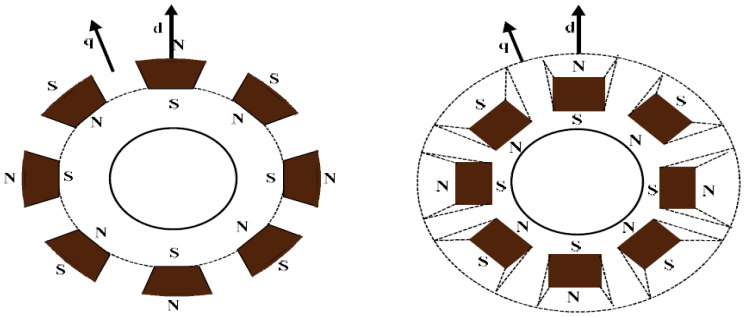

Fig1: (a) SPMSM (b) IPMSM

Stator Winding:

Based on the arrangement of stator windings, PMSM can also be divided as distributed winding and concentrated winding. Concentrated winding is employed where number of slots on the armature is equal to the number of poles in the machine; while in distributed winding conductors are placed in several slots under single pole.

Magnetic Flux Orientation:

Based on the magnetic flux orientation, PMSM can be group as a **radial flux and an axial flux machine.** Radial flux machine is constructed by placing stator around the rotor in a way to produce radial directed flux. In axial flux machine, the stator and the rotor are placed such that the air gap is perpendicular to the direction of rotation there by the main flux crosses the air gap in axial direction of rotation.

Number of Phases:

Based on the number of phases, machines in general can be two-phase, three-phase or multiphase (greater than three). Three-phase machines have been studied for long time and are widely available in numerous applications. In this study main focus is on six-phase PMSM.

Modeling Assumptions:

The model of PMSM without damper winding has been developed on rotor reference Frame using the following assumptions:

- Both the stator winding combination of six-phase are symmetrical.
- The winding capacitance is neglected.
- Concentrated winding are used to represent each of the distributed windings.
- The change in the inductance of the stator windings is sinusoidal due to rotor position and free from higher harmonics.
- Core losses are ignored.
- The magnetic circuits are linear (not saturated) and the inductance values do not depend on the current.

In this study, a six-phase PMSM with two three-phase windings is adopted where *ABC* winding is spatially 30 electrical degrees phase led to *XYZ* winding the following figure shows stator winding of six-phase PMSM motor.

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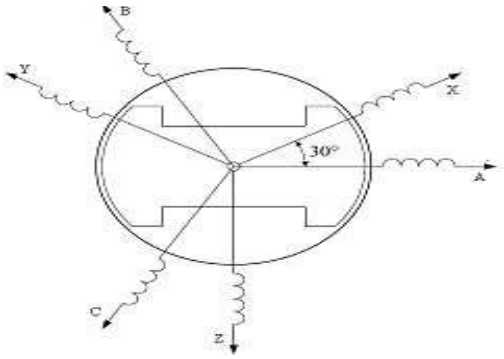

Fig.2: stator winding of six-phase PMSM motor

Dynamic Modeling of Six-phase PMSM:

$$V_{ABC} = R_S I_{ABC} + \frac{d\emptyset_{ABC}}{dt} \quad (1)$$

$$\Phi_{ABC} = L_{11} I_{ABC} + L_{12} I_{XYZ} + \Phi'_{MABC} \quad (2)$$

$$V_{XYZ} = R_S I_{XYZ} + \frac{d\emptyset_{XYZ}}{dt} \quad (3)$$

$$\emptyset_{XYZ} = L_{22} I_{XYZ} + L_{21} I_{ABC} + \emptyset'_{MXYZ} \quad (4)$$

Where, Rs = diag $[Rs, Rs, Rs]^T$ is the stator resistance vector; $V_{ABC} = [V_A\ V_B\ V_C]^T$ is the phase voltage vector of abc winding; $I_{ABC} = [i_A\ i_B\ i_C]^T$ is the current vector of ABC winding; $V_{XYZ} = [V_X\ V_Y\ V_Z]^T$ is the phase voltage vector of winding; $I_{XYZ} = [i_X\ i_Y\ i_Z]^T$ is the current vector of XYZ winding; $\emptyset_{ABC} = [\emptyset_A \emptyset_B \emptyset_C]^T$ is the stator flux linkage vector of ABC winding; $\emptyset_{XYZ} = [\emptyset_X \emptyset_Y \emptyset_Z]^T$ is the stator flux linkage vector of *XYZ* winding; L_{11} is the stator inductance vector of ABC winding; L_{22} is the stator inductance vector of *XYZ* winding; L_{12} and L_{21} are the mutual inductance vectors; $\emptyset'_{MABC}$ is the permanent-magnet flux linkage vector of ABC winding; $\emptyset'_{MXYZ}$ is the permanent-magnet flux linkage vector of *XYZ* winding.

In order to control the six-phase PMSM, the following transformation matrixes have been used to transfer the above equations into the synchronous rotating reference frame:

$$Tqd1 = \frac{2}{3}\begin{bmatrix} \cos\theta_e & \cos(\theta_e - 120^0) & \cos(\theta_e + 120^0) \\ \sin\theta_e & \sin(\theta_e - 120^0) & \sin(\theta_e + 120^0) \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix} \quad (5)$$

$$Tqd2 = \frac{2}{3}\begin{bmatrix} \cos(\theta_e - 30^0) & \cos(\theta_e - 150^0) & \cos(\theta_e + 90^0) \\ \sin(\theta_e - 30^0) & \sin(\theta_e - 150^0) & \sin(\theta_e + 90^0) \\ \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \end{bmatrix} \quad (6)$$

Where, T_{qd1} is the transformation matrix for ABC winding; T_{qd2} is the transformation matrix for XYZ winding; θe is the rotor flux angle. Moreover, the machine model of a six-phase PMSM can be described in synchronous rotating reference frame as follows:

$$v_{q1} = R_s I_{q1} + L_{q11}\frac{dI_{q1}}{dt} + \omega_e (L_{d11} I_{d1} + \phi_{PM}) \quad (7)$$

$$v_{d1} = R_s I_{d1} + L_{d11}\frac{dI_{d1}}{dt} - \omega_e L_{q11} I_{q1} \quad (8)$$

$$v_{q2} = R_s I_{q2} + L_{q22}\frac{dI_{q2}}{dt} + \omega_e (L_{d22} I_{d2} + \phi_{PM}) \quad (9)$$

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$$v_{d2} = R_s I_{d2} + L_{d22}\frac{dI_{d2}}{dt} - \omega_e L_{q22} I_{q2} \quad (10)$$

$$\omega_e = \frac{P}{2}\omega_r \quad (11)$$

Where, v_{d1} and v_{q1} are the *d-q* axis voltages of *ABC* winding; v_{d2} and v_{q2} are the *d-q* axis voltages of *XYZ* winding; I_{d1} and I_{q1} are the *d-q* axis currents of *ABC* winding; I_{d2} and I_{q2} are the *d-q* axis currents of *XYZ* winding; L_{d11} and L_{q11} are the *d-q* axis inductances of *ABC* winding; L_{d22} and L_{q22} are the *d-q* axis inductances of *XYZ* winding; ω_r is the rotor angular velocity; ω_e is the electrical angular velocity; $\emptyset_{PM}$ is the permanent magnet flux linkage; P is the number of poles of six-phase PMSM. As assumed that winding sets are identical ($L_{q11} = L_{q22} = L_q$ and $L_{d11} = L_{d22} = L_d$) Furthermore, the developed electric torque *Te* can be represented by the following equation:

In addition, the mechanical dynamic equation of the six-phase PMSM is:

$$T_e = \frac{3}{2}\frac{P}{2}\left[\phi_{PM}\left(I_{q1} + I_{q2}\right) + \left(L_d - L_q\right)\left(I_{d1}I_{q1} + I_{d2}I_{q2}\right)\right] \quad (12)$$

$$T_e = J\frac{d\omega_r}{dt} + B\omega_r + T_L \quad (13)$$

Where, J is the inertia of six-phase PMSM; B is the damping Coefficient; T_L is the load torque.

Solving for the rotor mechanical speed from equation (13)

We have

$$\omega_r = \int\left(\frac{T_e - T_L - B\omega_r}{J}\right)dt \quad (14)$$

$$\omega_e = \frac{P}{2}\omega_r \quad (15)$$

The rotor flux rotates at speed ω_r and its position angle can be obtained with respect to an arbitrary reference axis as:

$$\theta = \int\omega_r dt \quad (16)$$

The following transformation matrices have been used to transfer the equations from synchronous rotating reference frame to stator reference frame:

$$T_{ABC} = \begin{bmatrix} Cos\theta_e & Sin\theta_e & 1 \\ Cos(\theta_e - 120^0) & \sin(\theta_e - 120^0) & 1 \\ Cos(\theta_e + 120^0) & Sin(\theta_e + 120^0) & 1 \end{bmatrix} \quad (17)$$

$$T_{XYZ} = \begin{bmatrix} Cos(\theta_e - 30^0) & Sin(\theta_e - 30^0) & 1 \\ Cos(\theta_e - 150^0) & \sin(\theta_e - 150^0) & 1 \\ Cos(\theta_e + 90^0) & Sin(\theta_e + 90^0) & 1 \end{bmatrix} \quad (18)$$

Where T_{ABC} is the transformation matrix from dq0 to ABC and T_{XYZ} is for converting dq0 into XYZ.

Proposed Drive System:

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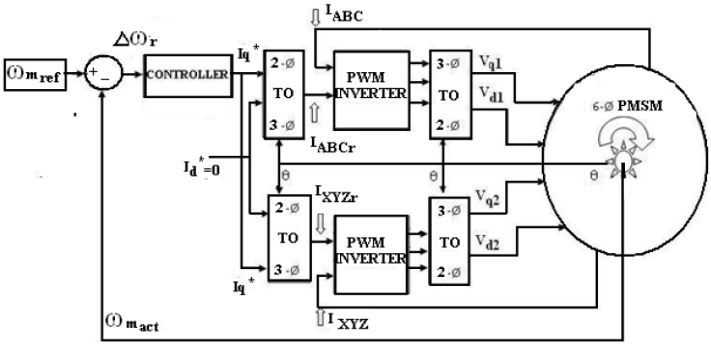

Fig.3: Proposed Drive System

Control Process:

The deviation between the set input speed (ω_{mref}) and the feedback speed (ω_{mact}) is a variable $\Delta\omega_r$ which is known as tracking error. This tracking error signal is send to controller which generates Iq* known as q-axis command current or torque generating current component. This output of controller Iq* and Id*(=0) are transformed to ABC and XYZ current command using 2-Ø to 3-Ø conversion (Inverse park's transform) by using rotor position angle θ in the form of I_{ABCr} and I_{XYZr}, These command currents are now compared with the actual feedback currents I_{ABC} and I_{XYZ} to generate the PWM signals which will than fire the semiconductor devices to produce actual three phase voltages. Again these voltages are transformed by using 3-Ø to 2-Ø conversion (Park's transformation) into d-axis and q-axis components of voltages and fed into the proposed six-phase motor model. With these new input voltages again speed and position of rotor is feedback to the system for the new values and again the whole process repeats itself till the error gets minimized.

Simulation results:

The presented model of six phase PMSM drive system has been simulated under various load conditions for 0.6 Seconds.

***Case I: No-Load operation*:** The model is simulated at no-load ($T_L = 0$) and at rated reference speed ($\omega_r = 35.6$ rad/sec.). Fig.4 shows the six phase stator surrent, rotor speed, and Torque response of the proposed scheme. The simulation results show that at 0.07sec. speed reaches, it's steady state value(rated speed).

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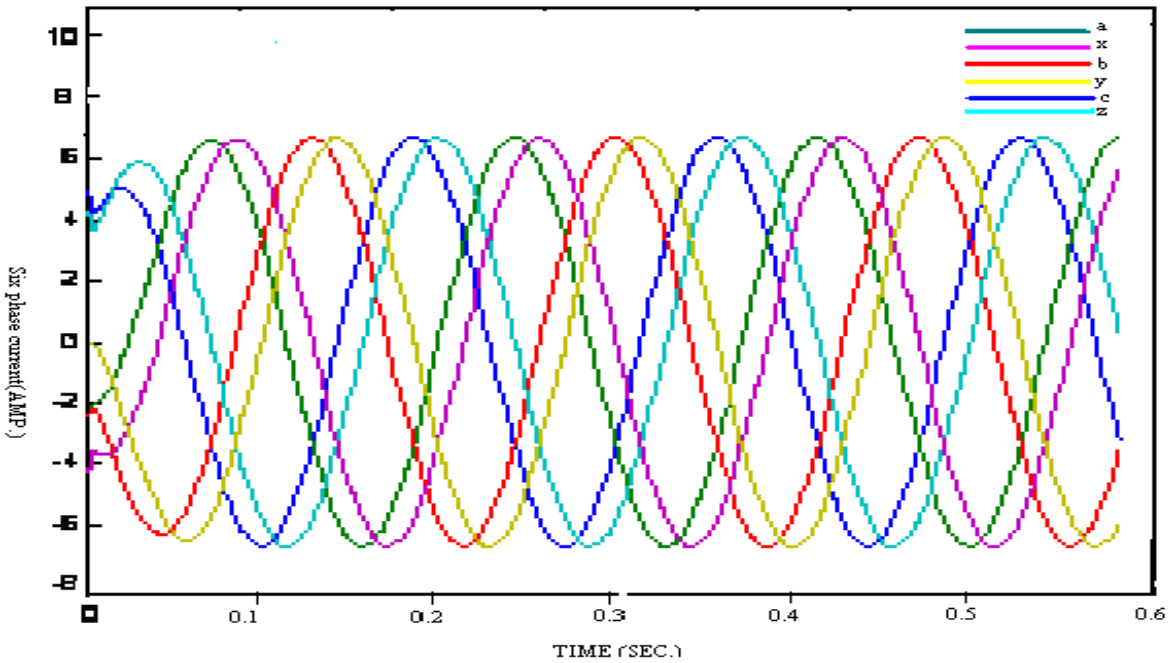
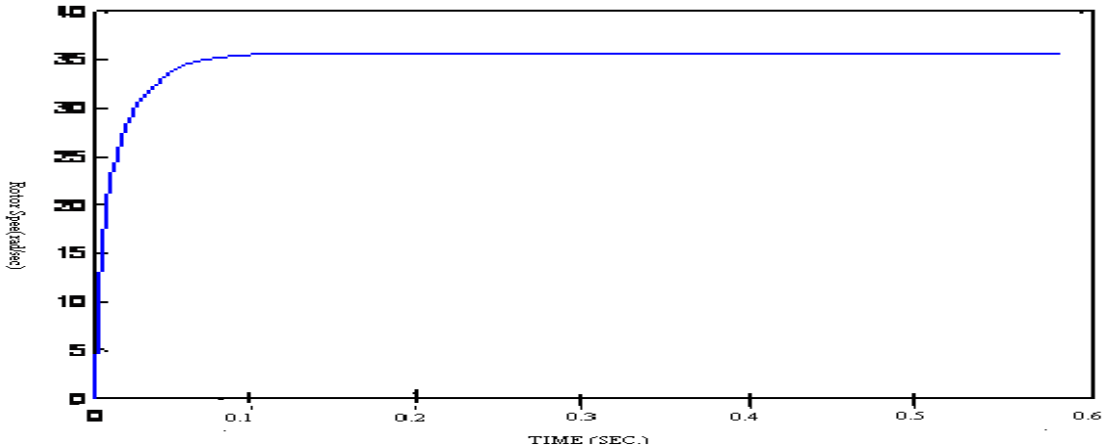
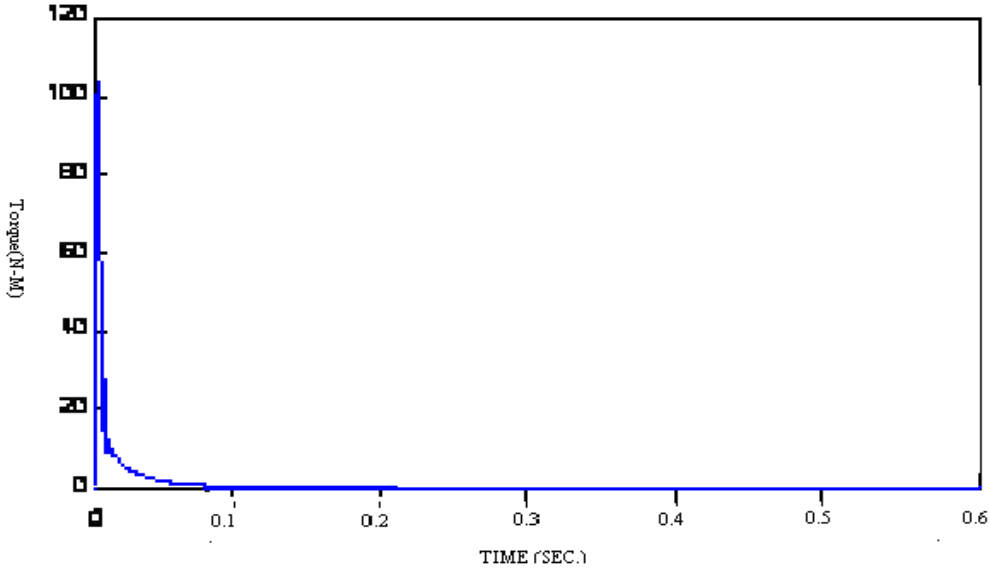




(a) (b)



(c)

Fig. 4 At no-load (a) Six-phase stator currents (b) Rotor speed (c) Torque

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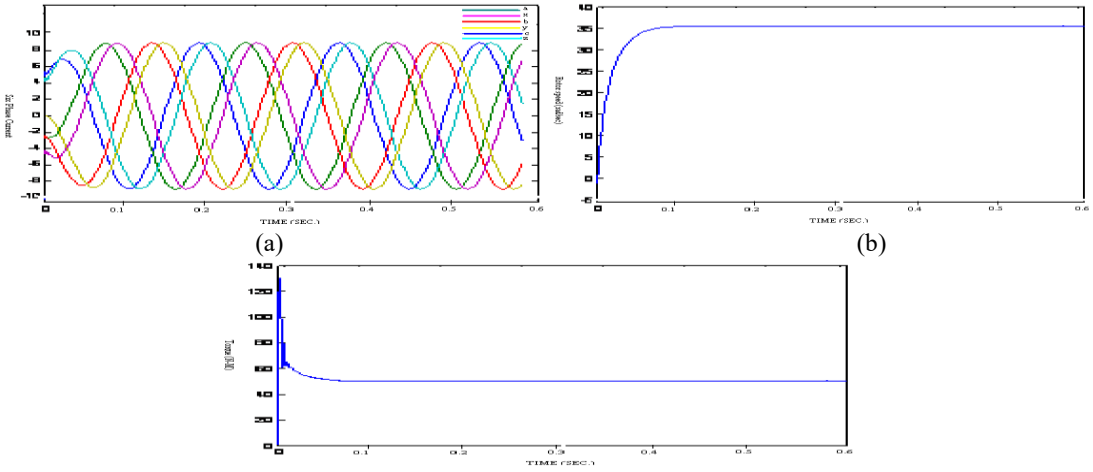
Case II: Steady state operation: (Load torque is fixed): The model is simulated at load Torque (T_L=50 N-M) and at rated speed (ω_r = 35.6 rad/sec.). Fig;5 shows that when load torque is set at 50 N-M the stator current increases slightly and at 0.07sec it reaches to the set load torque. Fig.4 shows the six phase stator current, rotor speed, and Torque response respectively, of the proposed scheme.

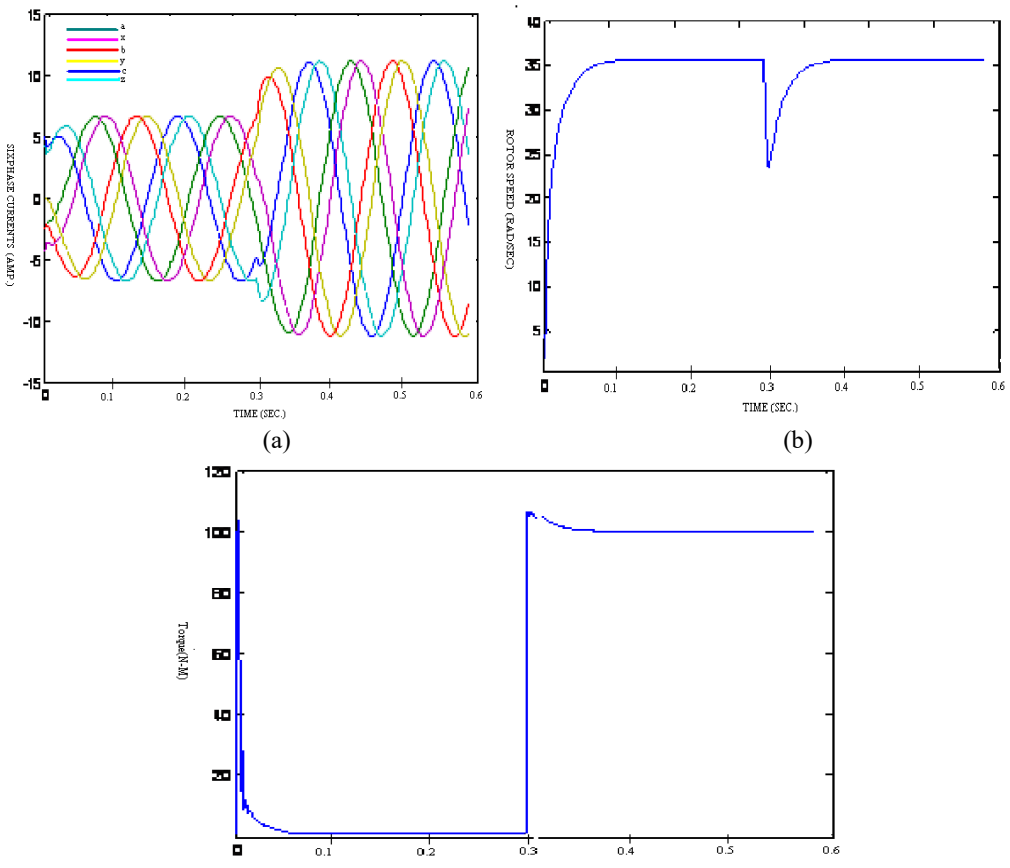


(a) (b)

(c)

Fig: 5 At Load Torque=50N-M (a) Six-phase stator currents (b) Rotor speed (c) Torque

Case III: Dynamic operation: The model has been simulated For dynamic load operation, load torque is initially set to Zero and at 0.3sec.load torque is suddenly changed to 100 N-M. Fig: 6 shows that When load Torque is applied suddenly at 0.3sec. (From T_L=0 to T_L=100N-M) the Six phase stator current increases and speed falls back to 22.6rad/sec. The recovery time of rotor speed to come back to rated speed after applying load torque (at .3sec.) is .085sec.



(a) (b)

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(c)

Fig:5 (a) Six phase stator current (b) Rotor speed (c) Torque

Conclusion:

Mathematical and computer model of multiphase motor with six-phase stator winding and Permanent magnet rotor in the synchronous reference frame is elaborated. Starting transients of torque, speed and current obtained by solving of differential equations of the motor. The simulation results are obtained under various load conditions and results demonstrate that the proposed model is able to operate at rated speed and torque even with there is sudden change of load torque. Overall it can be said that the performance of the proposed scheme is satisfactory.

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CHAPTER 8
INTRODUCTION TO ENGLISH LITERATURE

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Introduction

Humans have been using various mediums to express their thoughts for a long time, and one such medium is literature. Through literature, people have been expressing themselves for many years. Literature tells us what was happening in any given period — whether it was politics, how people lived, or what the traditions and culture of that time were.

Definition of Literature

Any written work that can be considered art—whether it is fiction, a poem, or a drama—is called literature. Now, what does art mean? Why is any work considered literature? Because not every written work can be called literature. A question should come to your mind when you think about any written work—for example, a newspaper. People write articles and paragraphs on Facebook, books are filled with facts, or even the lines written on the back of a medicine pack—are all these literatures, if written work is literature? Then are all these things also literature? No, they are not.

As of today, the definition of literature is that any work is considered great literature only when it fulfils three things: First, it should have a deep or hidden meaning—something that can be interpreted. For example, if I write a newspaper article today, it might have meant for now, but in the long term, no one will read it. Today it's news, so people read it; later, no one will. Second, what is its purpose? It should be beautiful. Literature must also be beautiful. And third, and most importantly, it should contribute to society, that is, it should give something to society. Such work is called literature, and anything written or oral that fulfils these three things can survive for a long time.

Now the question arises: why are we saying this? Because everyone has a different reason for writing. Some write for one reason, some for another. Some write for fun, some to earn money, some to make others laugh, some to point out flaws. Among these, one category writes to transfer knowledge. In earlier times, literature was used for entertainment and fun. We are not talking about today's time—we're talking about hundreds of years ago. It was used for fun, but slowly, it began to be written for the development of society, meaning something should be written from which future generations can learn something.

Speaking from today's perspective, literature's purpose should not be only entertainment. The purpose of literature should not be just beauty. It should rise above all this and aim to contribute to society or to change the reader. Art is something that, with the passage of time, does not lose its beauty. Now this may sound like a common line that everyone says, but we will also understand its meaning.

For example, there is a poem by William Butler Yeats called *The Second Coming*. This poem was written around the time of World War I. Every word of this poem is written so artistically that even after 100 years, this short poem is still alive. At that time, newspaper articles had huge audiences—

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hundreds of thousands of people read those articles that were also covering the time of war—but today, no one reads those articles, no one reads those newspapers, those articles aren't even alive today, nobody even knows about them.

And Yeats's poem, though very short, is still alive today and will remain alive for many centuries to come. So why is that? Because it was written artistically, that's why it's still alive. Every generation will interpret it in its own way. Because art never dies.

What is Literature

Any written (or occasionally spoken) work deemed to have artistic or intellectual merit is referred to as literature. It uses language to express human experiences, feelings, ideas, and imagination in addition to providing facts or information.

The term has historically been used to describe creative poetry and prose that stand out for their writers' goals and the perceived artistic quality of their execution. Numerous systems, such as language, national origin, historical time, genre, and topic matter, can be used to categorize literature.

Origin of Literature

The beginning of literature dates back to ancient times, when it served as a medium to record human experiences, ideas, feelings, and emotions. Initially, literature was oral, which means people used to speak and pass on stories verbally. Over generations, this oral tradition continued and evolved into forms such as storytelling, songs, and poems. Through literature, stories were told, songs were sung, and poems were recited. In this way, the origins of literature can be traced back to ancient times when it existed in oral form.

There are also some of the earliest literary works written by authors during ancient times. The first is from Mesopotamia: *The Epic of Gilgamesh*, which was written in cuneiform around 2100 BCE. Cuneiform is a wedge-shaped script in which writers used to write, and this work is considered the first known piece of literature.

The second is from Ancient Egypt, where many philosophical works were written. One of the most famous among them is the *Pyramid Texts* (c. 2400 BCE). Along with this, literary works were also composed, such as *The Instructions of Ptahhotep*, which reflected wisdom and philosophical ideas.

After Ancient Egypt comes Ancient India. In India, during ancient times, many significant works were written such as the *Vedas* and the *Upanishads* (circa 1500 BCE – 500 BCE). Apart from these, epic texts like the *Mahabharata* and the *Ramayana* were also written, which laid the foundation of Indian literature.

Next is Ancient Greece. Greek works have always been well-known and have had a significant influence on English literature. Greek literature flourished with Homer's *Iliad* and *Odyssey*, written around the 8th century BCE. These works explored themes such as heroism, gods, and human nature.

Lastly, we have Ancient China. Early Chinese literature also saw the creation of many works, such as *The Book of Songs* (*Shijing*) and the *Dao De Jing*. Writers of the ancient world wrote in their own

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unique styles, in their own languages, and in different ways. Even in ancient times, a vast amount of literary work was produced.

Writers used the materials available to them—such as clay tablets or bamboo and wood—for writing. As humans evolved and modernized, the styles of writing and the materials used also changed. However, in ancient times, writers wrote in their own manner and used to write wherever and whenever they got the chance.

Types of Literature

Poetry – Poetry is a very broad genre of writing because of this it is quite tricky to come up with one definition of what poetry actually is basically poetry is a form of imaginative writing people write poetry to express thoughts and feelings about something in a creative way. The purpose of poetry is to engage and excite the imagination of the reader or to stir a particular emotional response within them poets do this by carefully choosing and arranging language for it's meaning sound and rhythm.

Fiction – A literary work created from the imagination of writer is fiction. Though it can be inspired from real world. The word fiction is taken from the Latin word fiction, which means the act of making, fashioning, or molding". it includes Novel, Novella. Short stories)

Nonfiction – Nonfiction is a writing which uses similar techniques as fiction to create an interesting piece of writing about real events, Nonfiction is a genre of writing that presents factual information and real-life events, but often employs literary techniques commonly found in fiction—such as vivid descriptions, narrative structure, character development, and dialogue—to craft a compelling and engaging story. While the content remains rooted in truth, the style and presentation aim to capture the reader's attention and bring the events to life, making nonfiction not only informative but also entertaining and emotionally resonant.**(**e.g., biographies, essays)

Drama -In drama, action is presented in the form of "showing." For an enactment to take place, there must be some transformation in body language. Through changes in body language, one can enact an action. Dialogues are used, and actors also make use of facial expressions. Additionally, the stage can incorporate various elements to represent different categories of action.

For example, motifs can be used—these motifs might be objects that serve as symbolic standards within the play. They can represent certain themes and often carry significant climactic relevance. Take, for instance, the handkerchief in Shakespeare's *Othello*, which becomes a powerful motif.

Furthermore, the stage setting can be designed in such a way that it provides the audience with more and more information about the ongoing action. Through this design, a particular theme of the play can be highlighted. The representation of this theme helps communicate the core idea to the audience.

However, this communication does not occur through "telling," but through "showing." This, in essence, forms a general definition of drama.

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Scope of Literature

Literature encompasses a broad spectrum of forms, themes, and cultural representations. It includes any written or verbal works that mirror human experiences, thoughts, and imaginations, often aimed at entertaining, educating, or stimulating reflection. Below are significant areas within the realm of literature:

Themes: Literature delves into a variety of universal themes such as:

Human nature: Identity, morality, love, and loss.

Society and culture: Politics, justice, class, and race.

Philosophy and existentialism: The essence of life, individualism, freedom, and destiny.

Historical contexts: Representations of past events, struggles, or societal transformations.

Fantasy and imagination: Investigation of fictional worlds, the supernatural, and speculative narratives.

Cultural Perspectives: Literature showcases the variety of human cultures and histories, enabling the exploration of diverse values, beliefs, and traditions. Works can arise from any region, spanning from Ancient Greek literature to modern African pieces.

Various movements in literature have shaped its progression, including:

Classical Literature: (Ancient Greece and Rome)

Romanticism: (focusing on emotion and the natural world)

Modernism: (centred on innovation and challenging conventions)

Postmodernism: (questioning established truths and embracing contradictions)

Language and Style: This category also covers the use of diverse languages, writing techniques, and literary devices such as symbolism, allegory, satire, and metaphor.

History Of English Literature

The history of English literature begins in the period between the **6th century AD to the 11th century AD**, known as the Old English or Anglo-Saxon period. During this time, poetry was the main form of literary expression. Even the dramas of that era were composed in the form of long narrative poems. Two of the most famous narrative poems from this time are **"Beowulf"** and **"Widsith."**

Among these, *Beowulf* stands out as the most significant work and is often regarded as the **first English epic poem**. The author of *Beowulf* is unknown, but the poem is written in over **3,000 lines**. The story revolves around its heroic protagonist, Beowulf, who ultimately dies at the end of the tale. The poem provides insight into the **literary tastes of the audience of that time**, revealing their preference for heroic and adventurous tales. For this reason, *Beowulf* holds great importance in the study of early English literature.

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However, for modern readers, understanding Old English literature can be quite challenging. This is because the authors of that period used **alliteration** instead of rhyme, which was a key feature of their poetic style.

In addition to *Beowulf* and *Widsith*, many other important works were composed during the Old English period. Some notable examples include:

- *Genesis*
- *Exodus*
- *The Wanderer*
- *Christ and Satan*
- *The Dream of the Rood*
- *The Battle of Maldon*

Unfortunately, the authors of most of these works remain unknown. However, two significant names from this period are **Caedmon** and **Cynewulf**. Caedmon is considered the earliest known English poet, while **Cynewulf** is known for his **religious poetry** written in Old English.

After the Old English period, the next major era in English literary history is the **Middle English period**, which includes the works of **Geoffrey Chaucer**, one of the most important poets of the time. Chaucer was born around **the 1340s** in England. By **1357**, he had become a political servant in the British royal court.

Chaucer's most famous work is **"The Canterbury Tales,"** which is considered a cornerstone of Middle English literature. However, this work was **never completed**, as Chaucer passed away before he could finish writing it. Besides *The Canterbury Tales*, Chaucer also wrote an **elegy for his first wife**, titled **"The Book of the Duchess."**

Other notable figures from this period include **William Langland**, who wrote the religious allegorical poem **"Piers Plowman."** This period also saw a rise in **morality plays** and **miracle plays**, with *Everyman* being the most famous morality play of the time.

Another form of drama that emerged during this period was the **interlude**—short plays performed in the homes of wealthy patrons. The most prominent figure associated with interludes is **John Heywood**, who significantly contributed to this genre.

The Elizabethan Age: emerged during a time of significant political and social change in England. Following the tumultuous reign of Queen Mary I, Elizabeth I ascended to the throne in 1558, ushering in an era of relative peace and stability. The influence of the Renaissance, which emphasized humanism, individualism, and a revival of classical learning, permeated various aspects of society, including literature, art, and philosophy. This cultural renaissance laid the groundwork for the flourishing of English literature that would define the Elizabethan Age.

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Key writer of this periods are:

William Shakespeare, often referred to as the "Bard of Stratford," is perhaps the most celebrated playwright and poet of the Elizabethan Age. His extensive body of work includes 39 plays, 154 sonnets, and several narrative poems. Shakespeare's plays can be categorized into three main genres: tragedies, comedies, and histories.

His notable works are *Hamlet, Othello, Macbeth, Romeo and Juliet.*

Another prominent writer of the Elizabethan Age is **Christopher Marlowe**. A contemporary of Shakespeare, Marlowe was a key figure in the evolution of English drama. His groundbreaking use of blank verse and engaging narratives laid the groundwork for future playwrights. Among his notable works are *Doctor Faustus* and *Tamburlaine*.

Edmund Spenser is another renowned writer of the Elizabethan Age. He is most famous for his epic poem *The Faerie Queene*, which honors the Tudor dynasty and reflects the ideals of chivalry and virtue. His creative use of the Spenserian stanza—a nine-line stanza with a specific rhyme scheme (ABABBCBCC)—showcases his poetic skill and adds to the richness of Elizabethan literature. His notable work is *The Faerie Queene*.

Restoration Age

The Restoration Age, spanning from 1660 to 1700, marks a significant period in English history characterized by the restoration of the monarchy under King Charles II after a decade of republican rule. This era is notable for its vibrant cultural and literary revival, influenced by the reopening of theaters and the flourishing of arts and literature. The period began with Charles II's return to the throne, bringing stability and optimism, and the reopening of playhouses led to a resurgence in drama, particularly comedy and satire. Notable playwrights included William Congreve, known for *The Way of the World*, George Etherege, whose work *The Man of Mode* reflects social dynamics, and Aphra Behn, one of the first professional female playwrights, celebrated for *The Rover*. The Restoration Age also saw significant advancements in poetry and prose, marked by a shift towards realism. Poets like John Dryden and Andrew Marvell explored themes of love and politics, with Dryden's *Absalom and Achitophel* serving as a notable political satire. The rise of the novel began with writers like Daniel Defoe, whose *Robinson Crusoe* is considered one of the first novels in English literature. Additionally, satire became a prominent literary form, critiquing social and political issues, exemplified by Jonathan Swift's *A Modest Proposal*, a provocative satirical essay, and John Bunyan's *The Pilgrim's Progress*, which gained popularity for its allegorical critique of society. Overall, the Restoration Age was a transformative period in English literature and culture, marked by a renewed interest in the arts and significant contributions from key writers, laying the groundwork for future literary movements and making this era a pivotal chapter in the history of English literature.

Romanticism

The Romanticism Age, which flourished from the late 18th century to the mid-19th century, was a profound cultural and artistic movement that emerged as a reaction against the rationalism and industrialization of the Enlightenment and the preceding Neoclassical period. Characterized by an

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emphasis on emotion, individualism, and the sublime beauty of nature, Romanticism celebrated the imagination and the human spirit. Key figures of this movement included poets such as William Wordsworth, who emphasized the beauty of the natural world and the importance of personal experience, and Samuel Taylor Coleridge, known for his exploration of the supernatural and the mystical. The movement also produced notable writers like Lord Byron, whose works often featured heroic and rebellious characters, and Mary Shelley, whose novel *Frankenstein* delved into themes of creation and the consequences of unchecked ambition. Romanticism valued the subjective experience and the exploration of deep emotions, often drawing inspiration from folklore, mythology, and the past. This era also saw a shift towards the appreciation of the common man and the exploration of social and political themes, as seen in the works of authors like John Keats and Percy Bysshe Shelley. Overall, the Romanticism Age left a lasting impact on literature, art, and philosophy, emphasizing the importance of emotion, nature, and the individual experience in shaping human understanding and creativity.

Victorian Age

The **Victorian Age** refers to the period of Queen Victoria's reign over Britain, from 1837 to 1901. It was a time of significant social, political, economic, and cultural change. The era witnessed the expansion of the British Empire, the rise of the middle class, and major advancements in science, technology, and industry, all driven by the Industrial Revolution. Literature of the Victorian Age reflected the complexities of this transformation, often addressing themes such as social inequality, morality, industrialization, and the role of women. Prominent writers like Charles Dickens, Thomas Hardy, the Brontë sisters, Alfred Lord Tennyson, and Robert Browning explored both the hardships and the hopes of the time through novels, poetry, and essays. The Victorian Age was also marked by a strong sense of moral duty, religious debate, and a fascination with progress, making it one of the most influential periods in English literary history.

Modern Literature

Modern Literature refers to the body of literary work produced during the late 19th and 20th centuries, reflecting the dramatic changes in society, culture, and thought brought about by industrialization, world wars, and technological advancement. Unlike earlier literature, which often followed traditional forms and themes, modern literature is marked by a break from convention, embracing experimentation in style, structure, and language. Writers began to explore the inner workings of the human mind, often using techniques like stream of consciousness and fragmented narratives. Themes such as alienation, disillusionment, identity crisis, and the search for meaning became central. Prominent figures of modern literature include James Joyce, Virginia Woolf, T.S. Eliot, Franz Kafka, and William Faulkner. Their works reflect a world that was rapidly changing and often uncertain, capturing the complexities of modern life and the individual's place within it.

War Poetry

War Poetry is a literary genre that captures the experiences, emotions, and reflections of individuals affected by war, particularly soldiers and civilians. It became especially prominent during World War I, when poets began to depict the harsh realities of battle, challenging the glorified image of war often presented in earlier literature. War poetry conveys themes such as loss, trauma, patriotism,

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disillusionment, and the brutality of conflict. Unlike traditional heroic poetry, it often portrays the physical and psychological horrors of war with stark honesty. Poets like Wilfred Owen, Siegfried Sassoon, Rupert Brooke, and Isaac Rosenberg gave powerful voice to a generation devastated by violence and suffering. Their works serve not only as artistic expressions but also as historical testimonies that reveal the deep impact of war on the human soul.

Conclusion

The history of English literature is a rich and evolving journey that reflects the cultural, social, and intellectual developments of each era. From the oral traditions of ancient times to the structured poetry and drama of the classical and medieval periods, through the grandeur of the Renaissance, the introspection of the Romantic Age, the realism of the Victorian era, and the experimentation of modern and postmodern literature, English literature has continually adapted to the changing world. Each period brought its own unique voices, themes, and styles, contributing to a vast and diverse literary heritage. Understanding this historical progression not only deepens our appreciation of literary works but also helps us connect with the human experiences and ideas that have shaped civilization. As literature continues to evolve in the digital age, it remains a powerful reflection of society and a vital means of expressing the complexities of the human condition.

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CHAPTER 9
NET AND IT'S CONVERGENCE

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Introduction: -Nets were introduced to generalize sequences because sequences aren't enough to describe convergence in all topological spaces. Nets help define and study convergence, continuity, and compactness in more general spaces where sequences don't work.

Binary Relation:
A mapping ϕ: X×X → X is called binary relation on X if it satisfies the following property:

ϕ (a, b) = aϕb ∈ X where a, b ∈ X

This relation will satisfy for all the elements of X×X.

Example:
Let ϕ: N×N → N is a mapping defined by

ϕ (a, b) = a + b ∀ a, b ∈ N

which is binary relation on N because N is closed under binary operation '+'.

Directed set:
Let '≥' be the binary relation defined on set S then the ordered pair (S, ≥) is said to be directed set if it satisfies the following properties:

- a = a ⇒ a ≥ a ∀ a ∈ S
- a ≥ b and b ≥ c ⇒ a ≥ c ∀ a, b, c ∈ S
- for any two arbitrary a, b ∈ S ∃ p ∈ S such that p ≥ a and p ≥ b

Explanation of properties:

(i) First property says that every element of set Q is related to itself under the given binary relation "≥".

(ii) Second property says that if a is related to b and b is related to ci.e., any two elements of set Q are related to each other then a is also related to c which is transitivity property.

(iii) Third property says that a pair of any two arbitrary elements of set Q there exist at least one element which is related to both elements under the binary operation "≥".

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Example: Let X be any non-empty set.
Let $F = \{A \mid A \subset X\}$

F be the collection of all possible subset of X.
Now we will prove that F is directed set under the binary relation "$\subset$".

(i) We know that
$A \subset A \forall A \in F$
Reflexive property holds

(ii) We know that
$A \subset B, B \subset C \Rightarrow A \subset C \forall A, B, C \in F$
Transitivity property holds

(iii) For any two arbitrary $A, B \in F$
$\exists A \cap B \in F$ such that
$A \cap B \subset A$ and $A \cap B \subset B$

Third condition holds.

Hence $(F, \subset)$ is directed set.

Similarly, we can show that $(F, \supseteq)$ is directed set.

Residual subset: Let $(A, \geq)$ be directed set. Let $B \subset A$
then B is said to be Residual subset of A iff $\exists a \in A$ such that $\forall b \in B$ such that $b \geq a \Rightarrow b \in B$.

Example-1: Let N be set of natural numbers in which binary relation "$\geq$" (greater than equal to) is defined.
Now let $M \subset N$ and given by

$M = N - \{1, 2, 3\}$
$M = \{4, 5, 6, 7, 8, 9, ---\}$

We can select a number 4 which is greater than or equal to each element of set M.

Hence M is residual subset of N.

Example-2: Let $L \subset N$ and given by
$L = \{1, 3, 5, 7, ---\}$

We can select a number 2 which is grater than 1 satisfies the property but not in L similarly we can see {2,4,8……} it is collection of numbers which satisfy the property but not in L hence L is not a residual subset of N.

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Cofinal Subset: - Let (A, ≥) be directed set and let B⊂A be subset of A then B is said to be residual subset of A if and only it ∋ a∈A such that ∀ b∈A with the property b≥a then b∈B.

Example-1: Let N be set of natural numbers in which binary relation "≥" (greater than equal to) is defined.
Now let $M \subset N$ and given by

$M = N - \{1, 2, 3\}$
$M = \{4, 5, 6, 7, 8, 9, ---\}$

If we select any number from N we can see that M has grater or equal elements. i.e.

2∈ N ∋ 4∈M such that 4≥2

Similarly for other numbers that belong to N.

Hence (M, ≥) is cofinal subset of (N, ≥).

Example-2: Let $L \subset N$ and given by
$L = \{1, 3, 5, 7, ---\}$

Let 1∈N ∋ 1∈L such that 1≥1 similarly for all numbers of N.

Hence (L, ≥) be cofinal subset of (N, ≥).

NOTE: -Every residual subset of directed set is cofinal subset but the converse is not true as we saw in the previous example.

Net: - A net in a topological space (X, T) is a mapping f: A→X where (A, ≥) be directed set. It is also represented as (f, X, A, ≥).

Important Points: -

- A net is said to be in Y if and only if f(A)⊂Y i.e.∀ a ∈A⇒ f_a ∈Y
- A net f is said to be eventually in Y if and only if B⊂A where (A, ≥) be directed set and B be its residual subset such that f(B) ⊂ Y.

i.e.,∋ a∈A ∀ b∈B such that b≥a ⇒ f_b ∈Y.

- A net f is said to be frequently in Y if and only if B⊂A where (A, ≥) be directed set and B be its cofinal subset such that f(B) ⊂ Y.

i.e., ∀ a∈A ∋ b∈B such that b≥a ⇒ f_b ∈Y.

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Convergence of a net: - Let (f, X, A, ≥) be a net in X where (X, T) is topological space and (A, ≥) be directed set then f is said to be convergence to point x∈ X if and only if f is eventually in every nbd of x i.e. .,∃ a∈A ∀ b∈B such that b≥a ⇒ f_a ∈N. where N be arbitrary nbd of x.

Cluster point of a net: -: Let (f, X, A, ≥) be a net in X where (X, T) is topological space and (A, ≥) be directed set then a point x∈ X is said to be cluster point of f if and only if f is frequently in every nbd of x. i.e.,∀ a∈A ∃ b∈B such that b≥a ⇒ f_b ∈N. where N be arbitrary nbd of x.

Subnet: - Consider two nets (f, X, A, ≥) and (g, X, B, ≥) then g is said to be subnet of f if it satisfies the following property: -

∃ a mapping h: B→ A Such that

I. g = fh

II. ∀ a ∈ A ∃ b∈B Such that h(x)≥a ∀ x≥b

Subsequence: - Consider two nets (f, X, N, ≥) and (g, X, N, ≥) then g is said to be subnet of f if it satisfies the following property: -

∃ a mapping h: B→ A Such that

I. g = fh

II. ∀ n ∈ N ∃ m∈N Such that h(x)≥n ∀ x≥m where x ∈ N.

Theorems: -

Theorem 1: - Let (X, T) be discrete topological space then every net in X converge to every point in X.

Proof: - Let (X, T) be discrete topological space.

Then we have to prove that every net in X converge to every point in X.

Since (X, T) be discrete topological space.

⇒ T = {ϕ, X}

⇒ Null set and X are only open sets in X.

⇒ Every element of X has exactly one open set X.

i.e., N(x) = {X} ∀ x ∈ X

Now consider a net (f, X, A, ≥) where (A, ≥) be directed set. Let B be residual subset of the directed set (A, ≥) then ∃ a∈A ∀ b∈B such that b≥a ⇒ f_b ∈X

⇒ f is eventually in X which is only nbd of every point in X.

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⇒ f converges to every point in X.

This completes the proof.

Theorem 2: - Let (X, T) be topological space and Y⊆X then show that Y is T-open if and only if no net in X-Y converge to a point in Y.

Proof: -Part I: -Let (X, T) be topological space and Y⊆X

Then we have to prove that no net in X-Y converge to a point in Y.

Suppose if possible ∃ a net (f, X-Y, A, ≥) which converges to point $y_0 \in$ Y. where (A, ≥) be directed set.

Since Y is T-open and $y_0 \in$ Y

⇒ Y is nbd of y_0 {since every open set is nbd of each of its points.}

Since f converges to y_0.

⇒ f is eventually in every nbd of y_0.

⇒ f is eventually in Y.

Since f is eventually in both Y and X-Y which is a contradiction because no net can converge to two mutually disjoint sets.

Hence our assumption that ∃ a net (f, X-Y, A, ≥) which converges to point $y_0 \in$ Y is wrong.

Thus, no net in X-Y converge to a point in Y.

Part II: - Let no net in X-Y converge to a point in Y.

Then we have to prove that Y is T-open.

Suppose, if possible, Y is not T-open and let$y_0 \in$ Y

⇒ every nbd of y_0 intersects with X-Y.

i.e., N ∩ (X-Y) ≠ $\Phi \forall$ N ∈ N (y_0) where N (y_0) be the collection of all nbd of y_0.

Let $\varkappa_N \in$ N ∩ (X-Y)

We know that (N (y_0), ⊆) is directed set.

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We consider a net f: N (y_0) → X-Y define by

f(N) = $\varkappa_N \in N \cap (X-Y) \subseteq N$

⇒ f(N) = $\varkappa_N \in N$

Since (N $(y_0), \subseteq$) is directed set.

⇒ for every N ∈ N (y_0) ∃ M ∈ N (y_0) such that M ⊆ N

f(M) = $\varkappa_M \in M \cap (X-Y) \subseteq M \subseteq N$

⇒ f(M) = $\varkappa_M \in N$

⇒ f is eventually in every N which is nbd of y_0.

⇒ f converges to $y_0 \in Y$.

Which is a contradiction because no net in X-Y can converge to any point in Y.

Hence our assumption that Y is not T-open is wrong.

Thus, Y is T-open.

Theorem 3: - Let (X, T) be topological space and Y⊆X if $\varkappa_0$ is a point of X then $\varkappa_0 \in \bar{y}$ if and only if ∃ a net in Y converging to $\varkappa_0$.

Proof: - Let (X, T) be topological space and Y⊆X and $\varkappa_0 \in X$

Part I: - Let $\varkappa_0 \in \bar{y}$

Then we have to prove that ∃ a net in Y converging to $\varkappa_0$.

Since $\varkappa_0 \in \bar{y}$

⇒ every nbd of $\varkappa_0$ intersects with Y.

Let N $(\varkappa_0)$ be the collection of all possible nbd of $\varkappa_0$. Then

N ∩ Y $\Phi \forall$ N ∈ N (x_0)

Let $\varkappa_N \in N \cap Y$

We know that (N $(x_0), \subseteq$) is directed set.

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We consider a net f: N (x_0) → X-Y define by

f(N) = $\varkappa_N \in N \cap Y) \subseteq N$

⇒ f(N) = $\varkappa_N \in N$

Since (N $(x_0), \subseteq$) is directed set.

⇒ for every N ∈ N (x_0) ∃ M ∈ N (x_0) such that M ⊆ N

f(M) = $\varkappa_M \in M \cap Y \subseteq M \subseteq N$

⇒ f(M) = $\varkappa_M \in N$

⇒ f is eventually in every nbd N which is nbd of x_0.

⇒ f converges to $x_0 \in Y$.

Part II: - Let ∃ a net in Y converging to $\varkappa_0$.

Then we have to prove that $\varkappa_0 \in \bar{y}$

Let N $(\varkappa_0)$ be the collection of all possible nbd of $\varkappa_0$.

Let f: A→ Y be the net which converges to point $\varkappa_0$. Where (A, ≥) be directed set.

⇒ f is eventually in every nbd of $\varkappa_0$. i.e., ∃ a∈A ∀ b∈A such that b≥a ⇒ $f_b \in N \subseteq Y$

⇒ $f_b \in N \cap Y$

⇒ $N \cap Y \neq \phi$

⇒ $\varkappa_0$ is cluster or adherent

Point of Y ⇒ $\varkappa_0 \in \bar{y}$

This completes the proof.

Theorem 4: -Let (X, T) be topological space and Y⊆X and let $\varkappa_0 \in X$ is a limit point of Y if and only if ∃a net in Y- $\{\varkappa_0\}$ converges to $\{\varkappa_0\}$.

Proof: - Let (X, T) be topological space and Y⊆X and let $\varkappa_0 \in X$.

Part I: - Suppose $\varkappa_0 \in X$ is a limit point of Y

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Then we have to prove that ∃ a net in Y- $\{\varkappa_0\}$ converges to $\{\varkappa_0\}$.

Since $\varkappa_0 \in$ X is a limit point of Y

By definition of limit point

N ∩ Y- $\{\varkappa_0\} \neq \phi \forall$ N ∈ N (x_0), where N $(\varkappa_0)$ be the collection of all possible nbd of $\varkappa_0$.

Let $\varkappa_N \in$ N ∩ Y

We know that (N $(x_0), \subseteq$) is directed set.

We consider a net f: N $(x_0) \rightarrow$ Y- $\{\varkappa_0\}$ define by

f(N) = $\varkappa_N \in$ N ∩ Y- $\{\varkappa_0\} \subseteq$ N

⇒ f(N) = $\varkappa_N \in$ N

Since (N $(x_0), \subseteq$) is directed set.

⇒ for every N ∈ N (x_0) ∃ M ∈ N (x_0) such that M ⊆ N

f(M) = $\varkappa_M \in$ M ∩ Y ⊆ M ⊆ N

⇒ f(M) = $\varkappa_M \in$ N

⇒ f is eventually in every nbd N which is nbd of x_0.

⇒ f converges to $x_0 \in$ Y- $\{\varkappa_0\}$.

Part II: - Suppose ∃ a net in Y- $\{\varkappa_0\}$ converges to $\{\varkappa_0\}$.

Then we have to prove that $\varkappa_0 \in$ X is a limit point of Y.

Let N $(\varkappa_0)$ be the collection of all possible nbd of $\varkappa_0$.

Let (f, Y- $\{\varkappa_0\}$, A, ≥) be a net which converges to $\varkappa_0$. Where (A, ≥) be directed set.

Then ∃ a∈A ∀ b∈A such that b≥a ⇒ $f_b \in$N ∀ N ∈ N (x_0)

Since f: A→ Y- $\{\varkappa_0\}$ be net so f(b) ∈ Y- $\{\varkappa_0\}$

We get f(b) ∈ Y- $\{\varkappa_0\}$ ∩ N

⇒ Y- $\{\varkappa_0\}$ ∩ N ≠ $\phi \forall$ N ∈ N (x_0)

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$\Rightarrow \varkappa_0 \in X$ is a limit point of Y.

This completes the proof.

Theorem 5: - A topological space is Harsdorfiff every net in X can converge to almost one point.

Proof: - Part I: - Let (X, T) be topological space which is Harsdorf.

Then we have to prove that every net in X can converge to almost one point.

Let $x, y \in X$ such that $x \neq y$

Since X is Harsdorf

$\Rightarrow \exists$ two open sets G and $\mathscr{H}$ such that

$x \in G$, $y \in \mathscr{H}$ and $G \cap \mathscr{H} = \varphi$

Suppose if possible: $\exists$ a net f in X which converges to both points x and y.

f converges to point x

$\Rightarrow$ f is eventually in every nbd of x

Since $x \in G$ and G is open

$\Rightarrow$ G is nbd of x {because every open set is nbd of each of its points}

$\Rightarrow$ f is eventually in G

f converges to y

$\Rightarrow$ f is eventually in every nbd of y

Since $y \in \mathscr{H}$ and $\mathscr{H}$ is open

$\Rightarrow \mathscr{H}$ is nbd of y {because every open set is nbd of each of its points}

$\Rightarrow$ f is eventually in $\mathscr{H}$

Since f is eventually in G and $\mathscr{H}$

also, $G \cap \mathscr{H} = \phi$

$\Rightarrow$ f is eventually in two mutually disjoint sets. which is a contradiction.

Hence our assumption that $\exists$ a net in X which can converge to two distinct points is wrong

Hence every net in a Harsdorf space can converge to almost one point.

Part II: - Suppose no net in X can converge to almost one point.

Now we will prove that (X, T) is Harsdorf space

Suppose, if possible, X is not Harsdorf

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$\exists$ x, y $\in$ X such that x $\neq$ y

$\exists$ two open set G and $\mathscr{H}$ such that

x $\in$ G, y $\in\mathscr{H}$ and G $\cap$ $\mathscr{H}\neq\varphi$

Let x (G $\cap$ $\mathscr{H}$) $\in$ G $\cap$ $\mathscr{H}$

Let N(x) be collection of all possible nbd of x and N(y) be collection of all possible nbd of y

We know that

(N(x), $\subseteq$) and (N(y), $\subseteq$) are directed sets

Let P = N(x) $\times$ N(y)

We define a relation "$\geq$" on P

$(G_1, \mathscr{H}_1) \geq (G_2, \mathscr{H}_2) = G_1 \subseteq G_2$ and $\mathscr{H}_1 \subseteq \mathscr{H}_2$

clearly (P, $\geq$) be a directed set.

Now we consider a net f: P $\rightarrow$ X

defined by

f [(G, $\mathscr{H}$)] = x (G $\cap$ $\mathscr{H}$) $\in$ G $\cap$ $\mathscr{H}$

Since P is directed set and (G, $\mathscr{H}$) $\in$ P

$\exists$ ($\mathscr{M}$, $\mathbb{N}$) $\in$ P such that

(G, $\mathscr{H}$) $\leq$ ($\mathscr{M}$, $\mathbb{N}$) $\Rightarrow$

($\mathscr{M}$, $\mathbb{N}$) $\geq$ (G, $\mathscr{H}$) $\Rightarrow\mathscr{M}\subseteq$ G and $\mathbb{N}\subseteq\mathscr{H}$

$\Rightarrow\mathscr{M}\cap\mathbb{N}\subseteq$ G $\cap$ $\mathscr{H}$

taking

f ($\mathscr{M}$, $\mathbb{N}$): x ($\mathscr{M}$, $\mathbb{N}$) $\in\mathscr{M}\cap\mathbb{N}\subseteq$ G $\cap$ $\mathscr{H}$

$\Rightarrow$ x ($\mathscr{M}$, $\mathbb{N}$) $\in$ G $\cap$ $\mathscr{H}$

$\Rightarrow$ x ($\mathscr{M}$, $\mathbb{N}$) $\in$ G and x ($\mathscr{M}$, $\mathbb{N}$) $\in\mathscr{H}$

$\Rightarrow$ f is eventually in G and f is eventually in $\mathscr{H}$

$\Rightarrow$ f converges to both x and y

We get a contradiction that no net in X can converge more than one point.

Hence our assumption that (X, T) is not Harsdorf space is wrong

Hence (X, T) is Harsdorf space

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Theorem 6 - If (X, T) be a discrete topological space then show that a net (f, X, A, ≥) converge to a point p ∈ X ⇔ f is eventually in {p}

Proof: - Let (X, T) be discrete topological space.

Part I: - (f, X, A, ≥) → X converges to a point p ∈ X

Then we have to prove that

F is eventually in {p}.

Since f converges to a point p ∈ X

⇒ f is eventually in every nbd of p ∈ X

Since T is discrete topology so it also contains {p}

⇒ p ∈ {p} and {p} is open.

⇒ {p} is nbd of p

⇒ f is eventually in {p}

Part II: - Let f is eventually in {p}

Then we have to prove that

f converges to the point p

Since f converges to {p}

⇒ f is eventually in {p} i.e.

There exist a∈A Such that ∀ b∈ A such that b≥a ⇒ $f_b \in \{P\}$

We know that $\{P\}$ is the smallest nbd of point p so

$f_b \in \{P\} \subseteq N \ \forall \ N \in N(P)$

Where N(P) be the collection of all possible nbd of point p.

Hence f is eventually in every nbd of point p.

⇒ f converges to point p.

This completes the proof.

Theorem 7: - If (X, T) be a topological space and (f, X, A, ≥) be a net in X then p ∈ X is a cluster point of f iff p ∈ $\overline{s_a}$ ∀ a∈ A Where s_a = {f(x): x≥a in A} ∀a∈ A.

Proof: - Let (X, T) be a topological space and (f, X, A, ≥) be a net in X.

Part I: - Let p∈ X be cluster point of f.

Then we have to prove that

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$p \in \bar{s_a} \forall\ a \in A$

Where s_a = {f(x): x≥a in A}∀ a∈ A.

Since p is cluster point of f

⇒p is frequently in every nbd of p.

i.e., ∀ a∈ A there exist ∀ b∈ B Such that

b≥a ⇒ f(b) ∈N ∀ N∈ N(p)

Where N(p) be the collection of all possible nbd of point p. (A, ≥) be directed set and (B, ≥) be residual subset of A.

Since b≥a ∀ a∈ A ⇒ f(b) ∈ s_a {by definition of s_a}.

Since f(b) ∈ s_a and f(b) ∈ N ⇒ f(b) ∈ $N \cap s_a$

⇒ $N \cap s_a \neq \emptyset \forall$ N∈ N(p)

⇒ p is cluster (adherent) point of f.

⇒ $p \in \bar{s_a}$

Part II: - Let $p \in \bar{s_a} \forall$ a∈ A

Then we have to prove that

p∈ X is cluster point of f.

Since $p \in \bar{s_a}$

⇒ every nbd of p intersects with $\bar{s_a}$

⇒ $N \cap s_a \neq \emptyset \forall$ N∈ N(p)

We know that (N(p), ⊆) is a directed set.

Now we consider a net f: A→ X Such that

$b \geq a \Rightarrow$ f(b) = $x_{a_0} \in N \cap s_a$

Where B be the residual subset of directed set (A, ≥)

Since ∀ a∈ A and $b \geq a \Rightarrow$ f(b) ∈ $N \cap s_a$ ⊆N

⇒ f(b) ∈ N

⇒ f is frequently in N.

⇒ p is cluster point of f.

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Problem 1: - Let F be a cofinal subset of a directed set (D, ≥) then the restriction of ≥ to F makes it a directed set. If a net S: D→X converge to point $x \in X$ so does its restriction $s|_F$: F→ X

Solution: - Let F be a cofinal subset of a directed set (D, ≥)

Then we have to prove that

(F, ≥) be directed set and if a net S: D→X converge to point $x \in X$ so does its restriction $s|_F$: F→ X

Part I: - To prove (F, ≥) be directed set.

I. Reflexivity Property: -

Let f∈ F then

f∈ D {Since D is directed}

⇒ f≥f

II. Transitivity

Let $f_1, f_2, f_3 \in F$ Such that

$f_1 \geq f_2$ and $f_2 \geq f_3 \Rightarrow f_1 \geq f_3$ {Since F⊆ D}

III. For any two arbitrary elements $f_1, f_2 \in F$ there exist an element f ∈F Such that f≥ f_1 and f≥ f_2

Hence (F, ≥) be directed set.

Part II: - Now we will check if S:D→X converge to point $x \in X$ so does its restriction $s|_F$: F→ X

Since S converges to point x∈ X

⇒ S is eventually in every nbd of x i.e., there exist a∈ D such that ∀ b∈ D such that b≥a ⇒ s(b) ∈ N for all N ∈N(x)

Where N(x) be collection of all possible nbd of point x.

Since b∈ D and F be cofinal subset of D.

⇒∃ f∈ F such that

f≥b≥a ⇒ f≥a ⇒ s(f) ∈ N for all N∈ $N(x)$

Since here S be the restriction of F, we can replace S by $s|_F$ then we get

f≥a ∀ f ∈F ⇒ $s|_F$(f) ∈ N for all N∈ $N(x)$

⇒ $s|_F$is eventually in every nbd of x.

⇒ $s|_F$converges to point x.

This completes the proof.

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Problem 2: - Let T_1 and T_2 be two topologies on a set X and suppose $T_1 \subseteq T_2$. How are the convergence of nets (X, T_1) and (X, T_2) related to each-other?

Solution: - Suppose (X, T_1) and (X, T_2) are two topological spaces such that $T_1 \subseteq T_2$.

Then we have to check that how are the convergence of nets (X, T_1) and (X, T_2) related to each-other?

Let f be the net in X converges to point x related to topology T_2.

Then f is eventually in every nbd of x related to topology T_2.

Since $T_1 \subseteq T_2$

Some nbd of x which belongs to T_2 also belongs to T_1 and f is eventually in every nbd of x related to topology T_1.

Hence every net converges to a point related to stronger topology also converges to the same point related to weaker topology.

Now let us suppose the net f converges to point x in X related to weaker topology T_1.

$\Rightarrow$ f is eventually in every nbd of x in X related to topology T_1.

It may be possible that there exist a nbd of x which is in T_2but not in T_1 at which net f is not eventually then f will not converge to x related to topology T_2.

Hence the converse is not true i.e., every net converges to a point related to weaker topology need not to be converges at the same point related to stronger topology.

Theorem 8: - Prove that a subnet of a convergent net is again a convergent subnet of the original net.

Proof: - Let (X. T) be topological space and (f, X, A, $\geq$) be a net in X.

Let (g, X, B, $\geq$) be a convergent subnet of the original net (f, X, A, $\geq$).

Let (g_1, X, C, $\geq$) be a subnet of the convergent net (g, X, B, $\geq$).

Where (A, $\geq$), (B, $\geq$) and (c, $\geq$) are directed sets.

Then we have to prove that

(g_1, X, C, $\geq$) be convergent subnet of the original net (f, X, A, $\geq$).

Since (g, X, B, $\geq$) be subnet of the net (f, X, A, $\geq$).

By definition of subnet

$\ni$ a mapping h: B$\rightarrow$ A Such that

I. g = fh

II. $\forall$ a $\in$ A $\ni$ b$\in$B Such that h(x)$\geq$a $\forall$ x$\geq$b

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Since $(g_1, X, C, \geq)$ be subnet of the net $(g, X, B, \geq)$.

By definition of subnet

$\ni$ a mapping h_1: C$\rightarrow$ B Such that

I. $g_1 = gh_1$

II. $\forall$ b $\in$ B $\ni$ c$\in$C Such that $h_1(y) \geq b$ $\forall$ $y \geq c$

Now we will prove that $(g_1, X, C, \geq)$ be the subnet of the original net $(f, X, A, \geq)$.

Since h_1: C$\rightarrow$ B and h: B$\rightarrow$ A are two mappings then hoh_1: C$\rightarrow$ A be the composition mapping such that

i. $g_1 = f(ho h_1)$

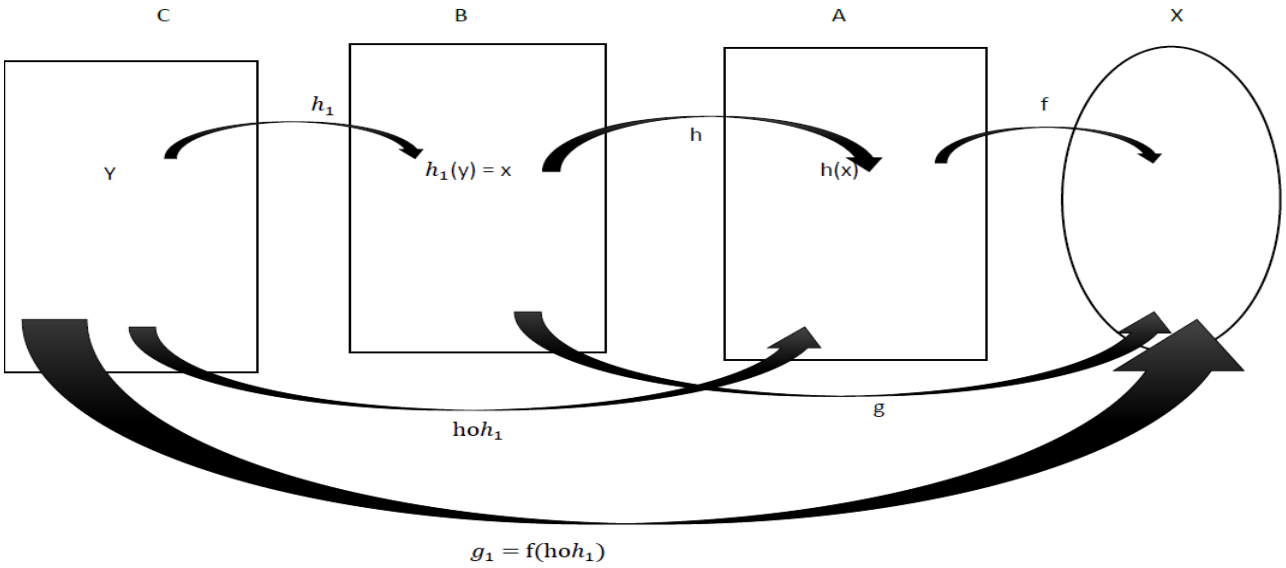
II. $\forall$ a $\in$ A $\ni$ c$\in$C and for $y \geq c$

$(ho h_1)(y) = h[h_1(y)]$

$= h(x) \geq a$

Hence $\forall$ a $\in$ A $\ni$ c$\in$C such that $(ho h_1)(y) \geq a$ for all $y \geq c$

Hence $(g_1, X, C, \geq)$ be the subnet of the original net $(f, X, A, \geq)$.



Let the net $(g_1, X, C, \geq)$ convergent to an arbitrary point x $\in$X.

Let N(x) be the collection of all possible nbd of x $\in$X.

Then g is eventually in every nbd of x.

i.e., $\ni$ b_1 $\in$ B such that $\forall$ b$\in$B such that $b \geq b_1 \Rightarrow g(b) \in N$ $\forall$ N$\in$N(x)

Let. $\ni$ c_1 $\in$ C such that $\forall$ c$\in$C such that $c \geq c_1$

Taking

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$(go h_1)(c) = g[h_1(c)]$

$(go h_1)(c) = g(b) \in N \; \forall \; N \in N(x)$

$\Rightarrow (go h_1) = g_1$ is eventually in every nbd of x.

$\Rightarrow g_1$ converges to point $x \in X$.

Hence $(g_1, X, C, \geq)$ be convergent subnet of the original net $(f, X, A, \geq)$.

This completes the proof.

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CHAPTER 10
TRANSFORMING LIBRARY SERVICES THROUGH EMERGING TECHNOLOGIES (A MULTISECTORAL PERPESTIVE ON AI)

Chhaya Tripathi

Department of Library and Information Science

Introduction

Libraries, once defined by their shelves of physical books and static reference materials, are now at the forefront of digital innovation. In the 21st century, technological advancement has become both a catalyst and a challenge for the evolution of library sciences. The integration of tools such as artificial intelligence (AI), cloud computing, blockchain, and immersive technologies like virtual and augmented reality has fundamentally altered the way libraries function, how users interact with them, and how knowledge is organized and accessed. Today's libraries operate within a hybrid environment—simultaneously safeguarding cultural memory and navigating rapid digital transformation. As user expectations shift, particularly among digitally native university students and researchers, libraries are compelled to provide more than just access to resources. Patrons increasingly demand intuitive, personalized, and seamless learning experiences that extend beyond physical walls. In response, libraries have adopted AI-driven chatbots, integrated VR/AR for interactive learning, and reimagined service delivery using mobile platforms and cloud infrastructures. However, these gains are not without their complications. Financial constraints, infrastructure gaps, and ethical concerns around data privacy and digital equity remain pressing. Technologies such as blockchain offer potential solutions for secure data preservation, yet introduce new ethical dilemmas regarding surveillance and institutional contro However, these gains are not without their complications. Financial constraints, infrastructure gaps, and ethical concerns around data privacy and digital equity remain pressing. Technologies such as blockchain offer potential solutions for secure data preservation, yet introduce new ethical dilemmas regarding surveillance and institutional control. Similarly, the increasing reliance on AI in cataloguing and recommendation engines necessitates scrutiny of algorithmic transparency and equity

This chapter investigates these evolving roles and frameworks, focusing on how technological innovations are shaping the future of library sciences. We will explore themes such as metaverse integration, smart library development, AI governance, and digital ethics. Through empirical examples and current research, we argue that libraries are not passive responders to technology but proactive agents of inclusive innovation. Their ability to balance cutting-edge tools with foundational values of access, equity, and intellectual freedom will define their resilience in the digital era.

Definition

Technological advancements have profoundly transformed the traditional concept and function of libraries. Once defined by shelves of physical books and static reference materials, libraries are now dynamic institutions at the forefront of digital innovation. In the 21st century, tools such as artificial intelligence (AI), cloud computing, blockchain, and immersive technologies like virtual and

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augmented reality have redefined how libraries function, how users interact with them, and how knowledge is organized and accessed.

Today's libraries operate in a hybrid environment, safeguarding cultural memory and navigating rapid digital transformation. As user expectations shift, particularly among digitally native students and researchers, libraries must provide more than mere access to resources. Patrons now demand intuitive, personalized, and seamless learning experiences that extend beyond physical walls.

Role of AI in Libraries

Artificial intelligence (AI) is transforming library operations through innovative applications that enhance cataloging, indexing, and user support. The integration of AI technologies, such as natural language processing (NLP) and chatbots, is particularly noteworthy, as these applications contribute significantly to operational efficiency.

In the context of cataloging and indexing, AI tools automate traditionally manual tasks. Automated book classification systems utilize algorithms to categorize library collections based on content analysis, greatly accelerating the cataloging process and improving the accuracy of indexes. This automation diminishes human error and allows librarians to focus on more complex tasks, such as curating resources and developing user-centric programs]. Furthermore, advancements in AI enable libraries to create smarter search functionalities that extend beyond keyword matching, facilitating a more intuitive user experience. By integrating AI-driven search algorithms, libraries can allow users to locate relevant materials quickly and efficiently, leading to an enhanced exploration of available resources.

In summary, the application of artificial intelligence in libraries is multifaceted, particularly in improving cataloging, indexing, and user support. Through automation, chatbots, and recommender systems, AI enhances operational efficiency, enriches user experiences, and ensures libraries continue to fulfill their educational and informational roles in a rapidly changing digital landscape.

Different Services:

1. Cloud-Based Service :

Cloud-based services and digital libraries are integral in enhancing access to information, fostering collaboration, and supporting remote users in various contexts across the globe. Cloud computing deployment has transformed traditional information access paradigms into more dynamic, extensive systems that provide numerous benefits, including scalable resources, reduced infrastructure costs, and improved data sharing capabilities.

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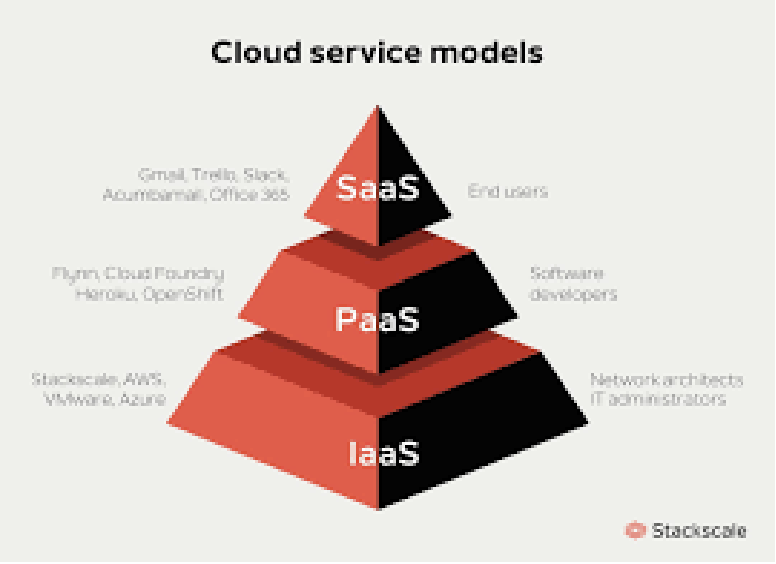
Figure 1. Structure of smart library in information age.

Cloud-based services such as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS) allow institutions to save on upfront costs associated with hardware and software installation, while facilitating access to a wide range of applications and platforms. The on-demand nature of these services empowers users with instant access to essential resources, addressing not only individual needs but also institutional requirements, especially in educational and research contexts. Such environments become increasingly collaborative when leveraging remote access features, enabling users to collaborate seamlessly regardless of geographical barriers.



2. Digital libraries :

Digital libraries greatly benefit from cloud infrastructure through improved resource sharing and data management. The ability to establish institutional repositories on cloud platforms leads libraries to aggregate a broad spectrum of research outputs, thereby creating centralized hubs of

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information that a diverse user base can access. The use of cloud resources has been shown to reduce the silo-related inefficiencies typically present in traditional libraries. In digital rights management, blockchain presents potential to streamline ownership verification and transaction processes for digital content, including books, articles, and media. Institutions are experimenting with blockchain-based systems designed to record transactions related to digital media, enabling libraries to track ownership and usage rights effectively.

Digital Library

3. Block-Chain Use:

In the realm of digital rights management, blockchain presents potential to streamline ownership verification and transaction processes for digital content, including books, articles, and media. Institutions are experimenting with blockchain-based systems designed to record transactions related to digital media, enabling libraries to track ownership and usage rights effectively Ma et al. Such systems can provide irrefutable proof of ownership, facilitate licensing of digital content, and ensure that authors and creators receive appropriate compensation for their work. A practical application is the development of systems utilizing smart contracts, which automate the enforcement of agreements made between parties regarding the use of digital content. Smart contracts facilitate automatic execution of predetermined conditions when terms are met, thereby minimizing the need for intermediaries. Despite the advantages of blockchain technology, several challenges and limitations must be addressed before widespread implementation in libraries can occur. A predominant barrier is the complexity associated with blockchain technology, which necessitates significant technical expertise among library personnel for effective deployment and management.

Blockchain also shows promise for enhancing the secure archiving of digital materials within libraries. By employing its immutable ledger features, blockchain can establish a permanent and tamper-proof record of document revisions and transfers, significantly

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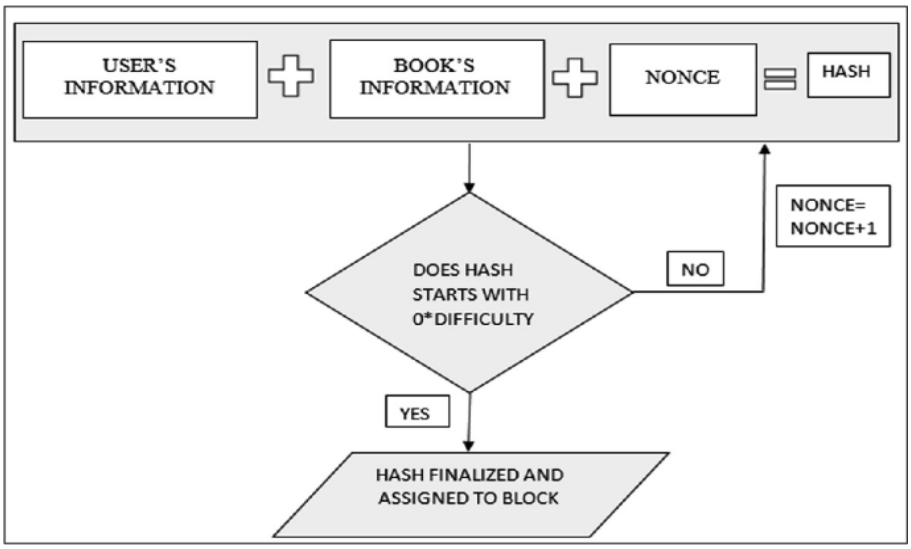
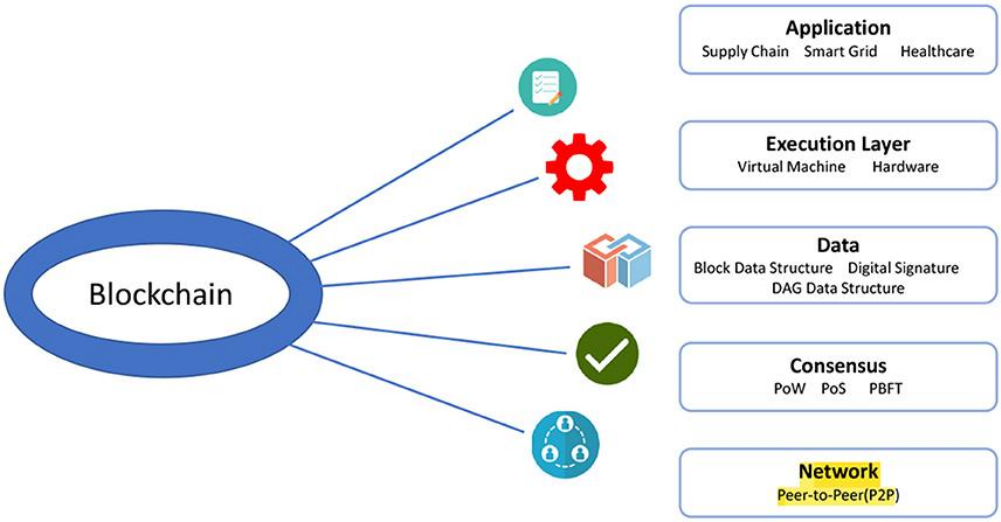
improving trust in the authenticity of library collections. Such systems ensure that once a document is archived, its integrity can be verified over time, which is crucial for maintaining accurate historical records. Despite the advantages of blockchain technology, several challenges and limitations must be addressed before widespread implementation in libraries can occur. A predominant barrier is the complexity associated with blockchain technology, which necessitates significant technical expertise among library personnel for effective deployment and management.





Integration of Technology in Libraries:

The integration of technology in libraries, especially in under-resourced or developing regions, has yielded innovative solutions that enhance user experiences, improve service delivery, and facilitate access to information. Various case studies illustrate successful implementations, including initiatives at Telkom University, mobile library applications, smart libraries, and

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consortial networks that collectively demonstrate how libraries can leverage technology for better engagement and resource management.

1. Telkom University Case Study

At Telkom University in Indonesia, the library has undergone considerable transformation through the integration of digital technology and smart services. The institution initiated a project that focuses on providing an interactive digital library environment, enhancing user engagement through its tailored digital resources. As part of this development, Telkom University deployed an intelligent library management system that leverages artificial intelligence and data analytics to understand user behavior and optimize service delivery Feng. This smart library initiative not only improves operational efficiencies but also enhances the user experience by offering personalized access to information, demonstrating that even in developing regions, libraries can adopt advanced technological tools to streamline services and address the specific needs of their users.

2. Mobile Library Applications

Mobile library applications have emerged as powerful tools for expanding library reach, especially in areas where access to physical library facilities is limited. An example can be drawn from the University of South Africa, which offers a mobile app designed to enhance the library experience for students across the country The app provides functionalities such as catalog access, digital lending, and notifications for upcoming events or new materials. This approach caters specifically to users in remote or rural areas, illustrating the effectiveness of mobile technology in overcoming barriers to information access and library engagement. Such applications have not only increased the visibility of library services but have also positively impacted students' academic performance, particularly in under-resourced contexts].

3. Smart Libraries:

The concept of smart libraries that utilize Internet of Things (IoT) technologies has taken root in various regions, notably in educational institutions striving for modernization. For instance, the implementation of IoT applications in libraries, as investigated by Khan et al., has led to the creation of smart library environments that enable real-time tracking of library resources, automated cataloging, and personalized recommendations [64][65]. Smart libraries enhance user interactions with library systems, thereby improving user satisfaction and operational efficiency. In developing regions, this transition has been crucial, offering libraries an opportunity to modernize their services and better meet the expectations of digital-savvy users

4. Consortial Networks:

Consortial networks have been pivotal in fostering collaborative resource sharing among libraries, notably in countries with fewer resources. A prime example is the African Library and Information Association (AfLIA), which unites various libraries across Africa to pool resources and enhance services]. Through these consortia, libraries can share electronic resources, databases, and digital collections, significantly expanding access to information for communities that might otherwise face limitations. The cooperative efforts established through these networks have allowed smaller

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libraries to access significant scholarly material, demonstrating the strength of collaboration in overcoming resource deficits

5. Integration with Emerging Technologies:

Several libraries in the global south have also been exploring the integration of emerging technologies such as cloud computing and big data analytics to improve management and service delivery For example, a library in Nigeria implemented a cloud-based library management system that allows for enhanced data storage, access, and sharing among various user groups. This approach simplifies library workflows and provides a robust system for managing vast amounts of digital information The success stories of these advancements indicate that the adoption of modern information technologies is essential for promoting effective library services, even in under-resourced environments.

User Surveillance

The implementation of digital technologies in libraries has led to increased data collection practices, which can pose ethical dilemmas related to user surveillance. While data can enhance user experiences by making services more personalized, concerns arise regarding privacy and the potential misuse of such data. Libraries must walk a fine line between benefitting from user data and protecting user confidentiality For example, tracking user activity can yield insights that help customize services but can also lead to surveillance that users might find intrusive, consequently deterring them from accessing library resources. To mitigate these issues, libraries should adopt transparent data practices, informing users about what data is collected, how it is used, and under what circumstances it might be shared with third parties. Establishing clear data use policies and obtaining informed consent can foster a climate of trust between libraries and their users

Access Inequality

Access inequality constitutes one of the most significant issues facing libraries as they digitize their services. Disparities in access to technology and the Internet can leave certain demographics behind, particularly low-income communities, rural populations, and individuals with disabilities. For instance, users without reliable Internet access or digital literacy skills may struggle to benefit from the vast resources available online, which exacerbates existing inequalities. It has been suggested that libraries adopt a dual strategy that not only expands digital resources but also enhances infrastructure and digital literacy programs to ensure equitable access for all community members This could involve partnerships with local organizations to provide technology training, devices, and reliable Internet access.

Open Access vs. Copyright

The tension between open access and copyright laws poses legal challenges for libraries transitioning to digital infrastructures. Open access aims to remove financial barriers to information, facilitating broader dissemination of knowledge, while copyright laws can restrict libraries from providing access to certain digital materials]. The challenge lies in navigating these competing ideologies, as libraries often operate within strict parameters set by copyright licenses. Several libraries have initiated projects that focus on promoting open access by collaborating with

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content creators to allow for sharing while managing copyright concerns .Strategies might include advocating for copyright reform that favors openness or developing institutional repositories that house materials available under open licenses.

Responsible Use of Artificial Intelligence

The deployment of AI in library services introduces another layer of ethical considerations. Although AI can streamline operations and enhance user experiences, the algorithms that drive AI systems are not free from bias and ethical pitfalls. For instance, AI tools might inadvertently prioritize certain types of information or users over others, leading to unequal access to services or resources. Libraries need to carefully consider which AI technologies they adopt and ensure they employ tools that promote fairness and transparency. Ongoing training in ethical AI practices and the establishment of frameworks to evaluate AI implementations can help libraries leverage technology responsibly .

Addressing Challenges Through Community Engagement

Libraries can confront these ethical, legal, and social challenges through proactive community engagement. By involving users in the decision-making process regarding digital services, libraries can better understand community needs and preferences. This engagement can also include dialogues surrounding privacy, equity, and access, fostering a community-centric approach that ensures library services are responsive to the diverse needs of all users .Furthermore, partnering with advocacy groups can amplify voices within underserved communities, promoting inclusive practices as libraries navigate these transitions.

Challenges and Limitations:

Despite the advantages of blockchain technology, several challenges and limitations must be addressed before widespread implementation in libraries can occur. A predominant barrier is the complexity associated with blockchain technology, which necessitates significant technical expertise among library personnel for effective deployment and management .Additionally, integrating blockchain solutions requires substantial initial investments and may meet resistance from stakeholders unaccustomed to digital technologies

Scalability and performance limitations of blockchain systems also present challenges. As the volume of transactions grows, issues concerning slow processing times and high transaction costs may arise due to the resource-intensive nature of blockchain operations [55]. While the decentralized nature of blockchain enhances transparency, it can complicate existing jurisdictional frameworks regarding intellectual property laws, as ownership details may be stored across multiple non-centralized locations globally

Secure Archiving and Content Authentication:

Blockchain also shows promise for enhancing the secure archiving of digital materials within libraries. By employing its immutable ledger features, blockchain can establish a permanent and tamper-proof record of document revisions and transfers, significantly improving trust in the authenticity of library collections. Such systems ensure that once a document is archived, its integrity can be verified over time, which is crucial for maintaining accurate historical records The

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concepts of authentication and provenance are equally vital in the context of scholarly content, where validating the credibility and originality of research outputs is paramount. Blockchain can facilitate mechanisms for verifying the authenticity of scholarly articles by providing a transparent trail that can be traced back to original sources, thus confirming authors' claims of originality and proper citation [57][58]. This fosters trust among users and promotes ethical scholarly practices by preventing plagiarism and unauthorized use of content.

Conlusion

Libraries are leveraging immersive technologies such as VR, AR, and the metaverse to promote user engagement and educational outcomes significantly. These advancements create opportunities for immersive learning experiences, facilitate the development of virtual spaces, and underline the importance of metaverse readiness. By embracing these technologies, libraries can foster innovative learning environments that meet modern educational needs and empower users in their lifelong learning journeys. The technological disruption facing the library profession compels librarians to evolve continuously, adopting new roles that encompass a wide array of competencies including data literacy, digital curation, instructional design, and technology integration. The collaboration between librarians and academic faculty must forge new paths that enrich the educational experience, benefiting both students and educators alike. By embracing these changes and pursuing lifelong learning, librarians can ensure their relevance and effectiveness in supporting the dynamic nature of information accessibility in the digital age.

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CHAPTER 11
HISTORY OF RENAISSANCE

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History of Renaissance

The Renaissance did not occur only in England but spread across many countries in Europe. The Renaissance is itself a very vast topic. Today, we will study in which European countries the Renaissance occurred, where it started first, how it reached England, and what impact it had on English literature.

First, let us understand that world history is divided into three parts: Ancient, Medieval, and Modern. The middle age, that is, the Medieval Age, is also called the Dark Age. After this Dark Age came the Renaissance.

This Dark Age prevailed in Europe from the 5th century AD to the 14th century AD. This period is called the Dark Age because during this time there was war, ignorance, death, and famine. During this time, the influence of the Church increased significantly, which is why there was no growth in art, culture, or literature.

The age before this was called the Ancient Age (Classical Age). In that age, civilization had made good progress because the Greek and Roman civilizations had surrounded Europe. There was growth in art during that age, but during the Medieval Age, Europe fell asleep. During this time, things like the Pope and the Church had established their dominance. So, it can be said that the Eastern civilization was better compared to the Western civilization.

The Arabs had already been to countries like India and China and had become much more developed than the Europeans. Now when the Europeans came in contact with the Arabs, they gained a lot. Learning from the Arabs, the Europeans thought that they also had great thinkers like Aristotle and many classical writers, and they should study them.

Turkey attacked Constantinople. This country was considered, at that time, to be a treasure house of knowledge. There were many Greek and Roman manuscripts in Constantinople. After the attack, the people of that place fled to Europe. The people who fled and went to Europe took those manuscripts with them to Italy. Then the people of Italy learned from those manuscripts and studied them. The Renaissance first began in Italy.

Definition

"Renaissance" is a French word that means "Rebirth." The Renaissance in Europe was an intellectual, cultural, and liberal movement that drew inspiration from the classical art, philosophy, and intellectual traditions of Ancient Greece and Rome. Although it began in Italy, it was not a historical event marked by a single date. It may have risen from one corner of Europe, but its waves spread across the entire world over the coming centuries, awakening not just Europe, but compelling the whole world to rise from slumber. The
Renaissance was the period when Europe broke free from the chains of the Middle Ages and stepped

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into the Modern Age. Rooted in Humanism and Realism, this European reawakening was truly unique. Whether we talk about art or culture, philosophy or science, politics or business—there is hardly any field that remained untouched by its influence. So let us try to understand and explore this powerful era."

A Turning Point in Human History

At the beginning of the 14th century, the Crusades marked the beginning of new connections between the Arab and European worlds. Through this relationship, Europe understood and adopted the knowledge of the Arab world. With the weakening of feudalism, people began to understand the old systems. The collapse of feudalism meant that people would no longer be solely under the control of kings and religion, but would also focus on their thoughts and rights. A major objective of this shift was human development and well-being, with a focus on the overall development of the individual. During this period, the common man began to be at the center, along with religion and rulers. People started to move away from blind faith and religious superstition and began
embracing rational and logical thinking. This led to the birth of new ideas and philosophies, one of which was the concept of humanism, which emphasized human rights, social values, and reason. This, in turn, gave rise to modern European thought. The influence of humanism was later seen during the French Revolution, from which values such as liberty, equality, and fraternity were born. These values later laid the groundwork for individualism and socialism.

The theory of socialism, which was widely opposed, also saw the emergence of the realistic interpretation of capitalism, which marked a shift in priorities. As a result, economic development, real-life achievements, and the comfort of human life began to be
given more importance, rather than focusing on religion and outward pleasures. This period laid the foundation for many of today's realistic theories, and it can be said that the roots of most of these theories can be traced back to this era.

Additionally, when we talk about art, we can confidently say that, no matter how little interest you might have in art, the developments during this period played a pivotal role in shaping modern art. The evolution of artistic expression, influenced by the philosophical and cultural shifts of the time, led to the development of various new forms and
techniques, which have had a lasting impact on the art world.

Humanism

Humanism was a movement that first began in Italy and gradually spread throughout Europe.

The meaning of humanism is to express human desires and abilities. Humanism helped people to understand human power and capabilities. With the arrival of humanism, the focus that was earlier on God now shifted towards humans. After the emergence of humanism, people started finding fulfillment in worldly life instead of focusing only on spiritual or afterlife matters.

An Important point to note here is that the early humanist thinkers never used the term humanism in their works. Instead, they used a term called studia humanitatis, which meant learning that focused on human abilities rather than theological subjects.

These thinkers believed that for a person to be truly civilized, classical knowledge was very important. They

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also believed that human beings are a great creation of God and that we can improve ourselves through learning.

During this time, the universities of Oxford and Cambridge also showed great progress because humanism placed a lot of emphasis on education and learning.

The main ideas of Renaissance humanists were very different from those of medieval Christianity. Their ideas were much more practical. On the other hand, the ideas of the medieval man were more rigid and dogmatic. In medieval Christianity, man was seen as a sinner. But the humanists saw great potential in people. They believed that humans have the power to give meaning to their own lives.

Origin of Humanism

The beginning of humanism is associated with three Italian authors: Petrarch, Dante, and Giovanni Boccaccio.

In **Dante's** book The Divine Comedy, it is shown how we can attain salvation (moksha). Alongside, some humanist subjects are also included in his work.

Similarly, **Petrarch**, who was a religious person, also talked about the corruption of the Catholic Church and, in a way, criticized it. Petrarch is also considered the Father of Humanism because he discovered many old manuscripts.

Giovanni Boccaccio also discovered many ancient manuscripts that were rich in classical knowledge and learning. In his work The Decameron, he depicted day-to-day human experiences. His and other humanistic works greatly influenced many other writers as well.

About the Thinkers Of this Era

1. **Leonardo da Vinci (1452–1519)**

You must have heard the name of Leonardo. He was a painter and an engineer. His most famous paintings are Mona Lisa and The Last Supper. Leonardo was not limited to just art – he studied the human body, designed machines like flying devices, and made plans for bridges and weapons. His works are full of things that show the way the world functions. He perfectly represented Renaissance ideas.

2. **Michelangelo Buonarroti (1475–1564)**

He was also a great genius in painting, architecture, and sculpture. Some of his famous works in art are the Statue of David and the Ceiling of the Sistine Chapel in the Vatican. He talked about the depth of physical and spiritual strength.

3. **Niccolò Machiavelli (1469–1527)**

He was a diplomat and political writer. He was from the country Florence. His belief was based on politics, and he thought that politics should be based on reality, not on morality. He introduced a new way of thinking about politics—based on practicality and real reasoning.

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4. **Desiderius Erasmus (1466–1536)**

Erasmus was a Dutch priest. He was a great scholar and humanist. He believed that the Church had become very corrupt in his time and wanted to change this bad situation through education. In his works, he also criticized the problems of the Church. He also highlighted in his works the benefits of reading classical texts. He made a great contribution to spreading Renaissance humanism in Europe.

5. **Thomas More (1478–1535**)

He was an English philosopher, writer, and lawyer. His most famous work is Utopia, in which he imagined a perfect place where people believe in equality and practice fairness. His ideas about society were excellent, and his voice was very important in Renaissance humanism.

6. **Francesco Petrarch (1304–1374)**

He is considered the first thinker of the Renaissance. He liked to read the works of Roman and Greek writers. He wrote many poems about love and nature, and he inspired many people among Renaissance scholars.

7. **Galileo Galilei (1564–1642**)

He continued his discoveries during the late Renaissance. He supported the heliocentric theory—that the Earth revolves around the Sun. His thinking challenged the Church and criticized its beliefs. He also contributed in fields like science and physics, laying the foundation for modern science.

8. **Giovanni Boccaccio (1313–1375**)

An Italian poet whose most famous book was The Decameron. In his works, he talked about love and wit, among other things. He used to write his works in Latin. He also read classical texts and supported humanist ideas.

9. **Leon Battista Alberti (1404–1472**)

A famous writer, architect, and philosopher who wrote a book about painting in which he talked about painters, art, and buildings. He created a perspective about art and the principles of symmetry in buildings.

At this time, art took a new form along with everything, technology and artistic work left their deep impact, whose effect can still be seen today. This was the same during the time of European imperialism and many architectural elements were also built in India, many architectural elements are also an effect of the Renaissance period.

If we try to understand this time from the front, This was the time of political and intellectual revolution. It was a time of scientific thinking, Among feudal lords and the church, The orthodox religion and the church had created such a society, In which innovation was suppressed. The mind was tied up. The church had declared scientific knowledge as bad.

Like we read about the Middle Ages, To come out of the circle of centuries took a lot of time. A very big reason here was the mentality associated with the church, Which supported bigotry and dogmatism. But the scientific revolution broke their mind-set and proved that the same scientific thoughts and inventions

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brought change. Also, many European countries' humanism thinking became active, Which gave new-found thinking, and from this time itself Many fields of Europe began to show excellence.

Let us understand with the example

Italy : We can call Italy the birthplace of the Renaissance. Big cities like Florence, Venice, and

Milan earned great names in art, architecture, and learning around the world. And this was just the beginning.

Every country wants to be better than the rest… to progress more. In the same way, Florence and Venice also started competing with each other—whether it was about their famous artists or anyone else.

Spain vs Portugal : These two cities became enemies of each other as development kept increasing.

Portugal discovered the sea route to India, and Spain discovered America through Christopher Columbus. These two countries made many inventions and explorations of new routes and cities. They were becoming powerful and now slowly wanted to take over the world.

France vs Italy: France was very impressed by Italy's culture and wealth. There were some Renaissance cities in France too, but later France attacked Italy. Now some cities of France had

developed greed—they wanted to become just as beautiful, powerful, and brilliant as Italy.

England vs France: We all know that the Renaissance came very late to England. And when Queen Elizabeth came to the throne, she wanted to see progress in art, literature, and music because she supported all of this.

At the same time, sea trade also became powerful. There was always conflict between parts of England and France, which later turned into colonial competition.

Holy Roman Empire (Germany) vs The Pope (Rome): At this time, many conflicts were happening about the Church and religion. In Germany, Martin Luther started protesting against the Catholic Church. And the Pope wanted everyone to remain under him.

But other countries started wanting freedom. Italy was the first to enter the Renaissance, but other countries like France, Spain, England, and Portugal wanted to surpass it.In the areas of trade, discovery, religion, and culture, everyone was in a race. And that race is still going on today. Competition will never end. Every country wanted its name to be on top and to become the leader of the world. Just like you read in the examples above. It was this competitive mind-set that made the Renaissance so influential, because of which a wave like the Enlightenment started.

Invention of printing press

Invention of printing press, which happened in the first half of the 15th century. Because of this, education and preaching process got a new birth. It played an important role in the spread of new ideas. And this Renaissance approach moved forward, which later gave rise to scientific revolution and industrial revolution in Europe."

let us understand with the example :-

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The spread of knowledge Rapidly: The name of the person who invented the printing press was Johannes Gutenberg. He invented the printing press around 1440 in Germany. Earlier, books used to be written by hand, which were obviously expensive and limited. Then when the printing press came, books started getting printed quickly, at lower costs, and in larger quantities.

Growth in Education: After this, when people started getting books, an interest in reading and writing began to arise in people's minds. And the number of educated people started increasing. Literacy rate in Europe increased very rapidly. Now when all these things became cheap, an entire generation got the chance to read and understand new ideas, and they took advantage of this opportunity.

Expansion of thoughts: Europe is a quite big country; when books written on Humanism, art, science, and philosophy started reaching every corner of Europe because people had interest in reading and in fulfilling the curiosity of their minds.

Now in this, scientists and thinkers had a very big role. They started publishing their discoveries and sharing them with the world.

Decline Church's influence: As you all know, earlier Church was the only source of knowledge because there were no books before and people's thinking was limited only to the church.

The printing press also brought religious texts to the people, which included translations of the Bible and spiritual books, through which people started understanding religion in their own way. And interest started increasing. This also empowered movements like the Protestant Reformation.

Recognition to Writers and Thinkers : Two big names of this age were Erasmus, Machiavelli, and Shakespeare, whose works people still remember today. They started spreading their ideas to the world at that time. And when the public read and adopted their ideas, due to which an intellectual revolution came.

The printing press did not let Renaissance ideas remain limited to one city, but spread them all over Europe. It brought a new revolution in all fields like education, art, science, and religion.

Economic Revolution

For the first time, a proper banking system was also developed in this age. Bankers provided financial support to artists and thinkers, which led to the growth of the Renaissance.

In big cities like Florence, Milan, and Venice, urban development happened. Because of trade and commerce, growth started in this area. Jobs and business opportunities started coming. People started business for profit. From here, the idea of capitalism developed.

There was improvement in farming techniques, new tools were introduced, and after that, the condition of crops became better, which led to an increase in food production.

The wealthy merchant families of big cities used to invest money not only in trade but also in banking, and they also supported great scholars financially.

Renaissance thinkers emphasized individual achievements, not only in art and literature but also in business. People started believing that wealth would come only through hard work. The thinkers began to study the economy scientifically. Their entire focus had shifted to practical economics, trade, and investment.

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As trade continued to grow, cities also started expanding. A powerful nation was formed, and Europe became a center of global trade.

Conclusion

In the 14th century, a reformation called Renaissance had a great influence on world-wide history. It started from Italy but then spread throughout Europe and quickly across the whole world. This era marks the rise of classical knowledge, human curiosity, and a shift from religious dogma to a human-centered approach.

Education and information came, and people started focusing on subjects like literature, history, and poetry. Many great scholars emerged in this age, like Leonardo da Vinci, Michelangelo. After that, art became very realistic and started to show human life.

In this age, some famous scholars like Dante and Shakespeare got a big boost in their careers. During this age, the printing press was also invented, after which knowledge became easily accessible among people… books started to be seen in every house. People actively started buying books.

In other fields like science, progress was made… many inventions started being done. Trade and business also started people began to understand the meaning of profit and loss.

There was also an economic revolution in this age, farming techniques improved, there was a rise in the banking system and merchant classes, and also in international trade. Political transformation happened, urbanization also took place, and the Renaissance gave humanity the courage and opportunity to show its brilliance.

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CHAPTER 12
Important role of INFLIBNET in the perspective of library service

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सारांश (Abstract) :–

ग्रंथालय अपने शैक्षणिक सेवाओं के लिए पहचाना जाता है। वर्तमान में इनफ्लिबनेट सेंटर द्वारा प्रदान की गई सेवा शैक्षणिक रूप से बहुत महत्वपूर्ण है। इसके द्वारा प्रदान की गई सेवा समय और पाठको के मांग के आवयकता अनुसार बढ़ती और बदलती रहती है। भारत के विश्वविद्यालय एवं महाविद्यालय को जोड़ने एवं पाठय सामग्री के आदान प्रदान में भी इनफ्लिबनेट का महत्वपूर्ण भूमिका है। इनफ्लिबनेट पाठकों एवं ग्रंथालय के सभी प्रकार के आवश्यकताओं को ध्यान में रखा गया चाहे वह शोध कार्य हो या निम्न स्तर के शैक्षणिक कार्य एवं अच्छी से अच्छी सेवा प्रदान करने के साथ ही वर्तमान में प्रचलित ग्रंथालय तकनीकों से परिचित करवाती है। यह नेटवर्क सेवाओं के समूह को हमारे सामने कुछ ही क्षणो में प्रस्तुत कर देती है।

प्रस्तावना (Introduction) :-

कोविड-19 महामारी एक विश्वव्यापी स्वास्थ्य संकट के रूप में शुरू हुई क्योंकि यह तेजी से राष्ट्रों में फैल गई और इसके हिस्से के रूप में अधिकांश देशों ने लॉकडाउन लागू किया। कोविड-19 महामारी के हालिया प्रकोप ने पूरी दुनिया को बदल दिया है और इसके परिणामस्वरूपए इस अवधि के दौरान प्रत्येक क्षेत्र ने अपनी सेवा वितरण विधियों का पुनर्वास किया है। पुस्तकालयों को अपने उपयोगकर्ताओं को सेवाएं प्रदान करने के तरीके में भी बदलाव करना पड़ा। 2020 के कोविड-19 महामारी का उच्च शिक्षा (भ्द्ध पुस्तकालयों पर अभूतपूर्व प्रभाव पड़ा हैए जिससे उन्हें अपनी सेवाओं में तेजी से सुधार करने और कम समय में डिजिटल में बदलाव को तेज करने की आवश्यकता पड़ी। सबसे महत्वपूर्ण चुनौतियों में से एक यह रही है कि छात्रों और अन्य पुस्तकालय उपयोगकर्ताओं को उन संसाधनों तक निरंतर पहुंच कैसे प्रदान की जाए जो पहले केवल प्रिंट में उपलब्ध थेए जब पुस्तकालय बंद हो गए हैं या प्रतिबंधों के साथ काम कर रहे हैं जो भौतिक पुस्तकालय स्थान तक पहुंच को सीमित करते हैं।

आज का युग सूचना प्रौद्योगिकी एवं सूचना विस्फोट का युग है जैसे–जैसे सूचना की उत्पत्ति निरन्तर बढ़ रही है वैसे ही उपभोक्ताओं की मॉग और व्यवहार भी बढ़ती जा रही है। और इन सबको सुरक्षित करने वाली संस्था पुस्तकालय एवं सूचना केन्द्र का स्वरूप भी बदलता जा रहा है। ग्रंथालय आधुनिक सूचना तकनिकों एवं शैक्षणिक सेवाओं के लिए पहचाना जाता है। ग्रंथालय किसी भी शैक्षणिक संस्था का केंद्र बिंदु होता है या कह सकते है कि पुस्तकालय, शैक्षणिक संस्था का हृदय स्थल होता है। जहॉ सभी प्रकार के पाठक आवश्यकतानुसार सूचना प्राप्त करते हैं। ग्रंथालय का प्रमुख कार्य पाठक को उनके आवश्कता के अनुसार सेवा प्रदान करना है, एवं उनके मांगों का ध्यान में रखकर उन्हें पाठ्य सामाग्री प्रदान करना है।

कोठारी शिक्षा आयोग (1964–66) ने भारत के विश्वविद्यालय के ग्रंथालय को जोड़ने के लिए साथ ही साथ ग्रंथालय के विकास के कार्यो को गति देने के लिए कार्य प्रारम्भ किया। इस आयोग ने ग्रंथालय को अनुसंधान का केंद्र बिंदु माना और उन्हे संसाधन प्रदान करने के लिए साधन प्रदान कियें।

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1, इनफ्लिबनेट : एक अवलोकन (INFLIBNET : An overview)

भारत के सभी विश्वविद्यालय के ग्रंथालय को जोड़ने के लिए विश्वविद्यालय अनुदान आयोग के द्वारा इस नेटवर्क की स्थापना कि गयी जिसे इनफ्लिबनेट का नाम दिया गया। जिसकी स्थापना में विश्वविद्यालय अनुदान आयोग नई दिल्ली की भूमिका महत्वपूर्ण रही । यू.जी.सी. के द्वारा प्रो. यशपाल की अध्यक्षता में समिति का गठन हुआ जिससे कि भारतीय विश्वविद्यालय के ग्रंथालयों में उपलब्ध संसाधनो का अधिक से अधिक सहभागी रूप से उपयोग किया जा सके। इनफ्लिबनेट सेंटर भारत सरकार की स्वायत संस्था है। 1988 में इनफ्लिबनेट अस्तित्व में आया और 1991 में विधिवत रूप से कार्य करना प्रारम्भ किया जिसका हेड क्वाटर गुजरात विश्वविद्यालय केम्पस अहमदाबाद है। शुरूवात में आई.यू.सी.ए.ए. के तहत एक परियोजना के रूप में शुरू किया गया यह जून 1996 में एक स्वतंत्र इंटर विश्वविद्यालय सेंटर बन गया। वर्तमान में इसके निदेशक डॉ.जगदीश अरोरा पदस्थ हैं।

इनफ्लिबनेट में सभी विषय क्षेत्रों के उच्चशिक्षा के विश्वविद्यालय__अनुसंधान संस्था एवं विकास संस्था तथा राष्ट्रीय संगठन जैसे आई.सी.एस.एस.आर, ए.आई.सी.टी.ई, डी.आर.डी.ओ., आई.सी.ए.आर., आई.सी.आई.आर, व डेलनेट आदी भागीदार है। इनफ्लिबनेट देश के इन केंद्रो को कम्प्यूटर एवं आधुनिक सम्प्रेषण के अनुप्रयोग से आधुनिकीकरण करने का महत्वपूर्ण योजना है।

2. इनफ्लिबनेट के उद्देश्य (Aim of INFLIBNET):–

- ग्रंथालय के कर्मचारियों में से एक कर्मचारी को एवं कम्प्यूटर विभाग के एक कर्मचारी को स्वचालन का प्रशिक्षण प्रदान करना।
- यू.जी.सी. के द्वारा समस्त विश्वविद्यालय को कम्प्यूटरीकृत करने एवं स्वचालन कार्य सहायता के लिए एक पद सूचना वैज्ञानिक स्विकृत किया गया।
- सभी विश्वविद्यालय को ग्रंथालय स्वचालन एवं कम्प्यूटरीकृत में सहायता के लिए 2–10 लाख अनुदान प्रदान किया जाता है।
- विश्वविद्यालय व महाविद्यालय के ग्रंथालय का कम्प्यूटरीकृत करने के लिए एक सोल सॉफ्टवेयर तैयार किया गया है। जो कम किमत पर उन्हे अपलब्ध किया जाता है। साथ ही उन्हे चलाने के लिए प्रशिक्षण प्रदान करते हैं। प्रशिक्षण के अलग अलग भाषा का भी प्रयोग किया जाता है ताकि उस विश्वविद्यालय या महाविद्यालय के स्थानीय लोगो को सुविधाजनक हो यह आइरटप्ला (IRTPLA) के नाम से जाना जाता है।
- डेटाबेस के द्वारा बहुत सारी सुविधा प्रदान कि जाती है जैसे– थिसित डेटाबेस, पत्रपत्रिकाओं का डेटाबेस विशेषज्ञ डेटाबेस ग्रंथो का डेटाबेस इत्यादी।
- इनफ्बिनेट के द्वारा मानकों के निर्धारण करने के लिए, कुछ मानक तैयार किये है जैसे (एग्लो, अमेरिकन, कैटालगिगं रूल्स) विषय शीर्षक सूची एव इनफ्बिनेट स्टैण्डर्ड एवं गाईड लाईन फॉर केपचरींग डाटा, ओ.सी.एल.सी.,सी.डी.रोम सेवा, प्रलेखन सेवा इत्यादि।

3. ग्रंथालय एवं सूचना नेटवर्क द्वारा प्रमुख सेवा (Main Service by INFLIBNET):-

3.1 शोधगंगा (ShodhGanga) :– इनफ्बिनेट के द्वारा प्रदान कि जाने वाली सेवाओं में यह प्रमुख सेवा है। यह डेटाबेस में इलेक्ट्रानिक थिसिस एवं लघु शोध प्रबंध का संकलन है। भारत के प्रमुख विश्वविद्यालयों से अवार्ड वाले शोध ग्रंथो को अपलोड किया जाता है एवं उपयोगकर्ता को ओपन एक्सेस सेवा प्रदान किया जाता है। उपयोगकर्ता कही भी इसका उपयोग करके इन थिसिस को डाउनलोड़ कर देख सकता है और अपने शोध कार्य में प्रयोग कर शोध को गुणवत्तापूर्ण बना सकता है।

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3.2 इनफ्लिबनेट सेंटर प्रकाशन (INFLIBNET center publication) :- इनफ्लिबनेट केंद्र के द्वारा नि.लि. प्रकाशन होते है

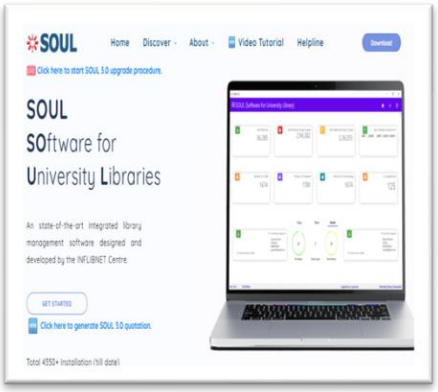
3.2.1 :– वार्षिक रिपोर्ट:– यह एक वार्षिक रिपोर्ट है जिससे भारत के सभी विश्वविद्यालय से सम्बंधित कार्यक्रमों एवं योजनाओं का लेखा जोखा होता है।

3.2.2 :– इनफ्लिबनेट न्यूजलेटर :– यह एक त्रैमासिक प्रकाशन है एवं कार्य–क्रियाओं की सूचना प्रदान करता है।

3.2.3 :– कैलिबनेट और प्लानर के वार्षिक कान्फ्रेस के द्वारा छपने वाला प्रोसेडिगं भी उपलब्ध है।

3.2.4 :– अन्य प्रकाशन, मार्क कोड सूची, सोल गाईड लाईन इत्यादि।

3.3 सोल साफ्टवेयर (Soul Software) :- यह सोल साफ्टवेयर इनफ्लिबनेट का महत्वपूर्ण पुस्तकालय प्रंबधन साफ्टवेयर है पुस्तकालय को स्वचालन एवं कम्प्यूटरीकृत करने में महत्वपूर्ण भूमिका निभाता है इसमें डाटा की प्रविष्टी 13 भाषाओं मे कर सकते हैं तथा इसमें कैटलॉगीन एएसीआर–1998 के द्वारा होती है एवं सबजेक्ट हेडींग के लिए ''लाईब्रेरी ऑफ कांग्रेस सब्जेकट हेडिंग'' लिया गया है। इसका सबसे पुराना वर्जन सोल 1.0 फिर सोल 3.0 वर्तमान में कार्यरत है। यह इनफ्लिबनेट के द्वारा बनाया गया है। इसलिए यह साफ्टवेयर विश्वविद्यालय और महाविद्यालय को कम से कम कीमत पर उपलब्ध है।



3.4 इन.डी.केट (INDCAT-online union catalogue of indian university) :– इनफ्लिबनेट के द्वारा बनाया गया यह डाटाबेस है। इसको ऑनलाईन यूनियन कैटलाग ऑफ इंडियन यूनीवर्सीटी कहा जाता है इस डाटाबेस में सभी विश्वविद्यालय के पुस्तकों, शोध पत्रिकाओं, जनरल इत्यादी के कैटलॉग दिये गये है। इस यूनीयन डेटाबेस में पाठ्य सामाग्री की बिबलियोग्राफी, विस्तार सेवा एवं अन्य सूचना दिया गया है। इसमें 184 विश्वविद्यालय के लगभग 13 करोड़ बुक, 2,77,581 थिसीस एवं 35,240 पत्रिका के बिबलोग्राफी एवं कैटलाग का वर्णन प्रस्तुत है। साथ ही साथ इसमें इलेक्ट्रानिक विडियो एवं आडियो को भी शामिल किया गया, जिससे शैक्षणिक जानकारी से सम्बधित विडीयो एवं आडियो को उपयोगकर्ता अपने आवश्यकतानुसार उपयोग कर सकें।

3.5 एन लिस्ट (N-LIST) :– यह डाटाबेस नेशनल पुस्कालय एवं सूचना सेवा इन्फ्रास्ट्रकचर के योगदान से बनाया गया है यह डाटाबेस महाविद्यालय के छात्र–छात्राओं के लिए बनाया है जिसमें कुछ महत्वपूर्ण पुस्तकें एवं जनरल जैसे अन्य पाठय सामाग्री का संकलन है। 21 मई 2018 तक कुल 2974 सरकारी गैर सरकारी एवं सहायता प्राप्त महाविद्यालय यूजीसी अधिनियम की धारा 12बी/2एफ के सदस्य होने पर इसकी सदस्यता प्राप्त हुई है। ई–संसाधनों तक पहुंचने के लिए लॉग–इन आईडी पासवर्ड इन 2974 कॉलेजों के अधिकृत उपयोगकर्ताओं को भेजा गया है। इसको केवल महाविद्यालय का अधिकृत पाठक ही प्रयोग में ला सकते है जब कोई महाविद्यायल इसका सदस्य बनता है तो उसके छात्र–छात्राओं, शिक्षक एवं शोध पाठक भी सदस्य बनते है।

3.6 यूजीसी–इन्फोनेट डिजिटल पुस्तकालय कन्सोर्टिया (UGC-INFONET Digital library consortium) :– यहा डेटाबेस दिसम्बर 2003 में डॉ0 ए.पी.जे. अब्दुल कलाम के सम्मान में स्थापित किया गया था जब वह भारत के राष्ट्रपति थे तो उन्होने सभी विश्वविद्यालय को जल्द से जल्द इन्टरनेट से सम्बंध प्रदान करने की अनुमति दी थी। वर्तमान में यह कन्सोर्टिया 26 प्रकाशक के द्वारा 7 हजार से अधिक जनरल एवं 10 बिबलियोग्राफी डेटाबेस प्रदान करता है। यह कन्सोर्टिया शैक्षणिक स्तर की लगभग सभी विषय को सम्मीलित किये हुये है जैसे कला,मानवशास्त्र, सा0 शास्त्र, विज्ञान, कम्प्यूटर विज्ञान, गणित, संख्यिकी, कानून इत्यादि। इसके द्वारा विश्वविद्यालय को कम कीमत पर बहुमूल्य पाठ्य सामाग्री प्राप्त होती है।

3.7 जे.सी.जी.सी–दस्तावेज वितरण (JCCC- Document delivery service):– यूजीसी के द्वारा यह सुविधा दि गयी है जिनके तहत इन्फोनेट डिजिटल लाईब्रेरी कन्सोर्टिया के साथ साथ इंटर लाइब्रेरी लोन दिया जाता है इसका मतलब है कि इनफ्लिबनेट से जुड़े सभी विश्वविद्यालय के पास अपनी अलग अलग जनरल होते है इस लोन के अंर्तगत एवं इनफ्लिबनेट

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सेंटर के द्वारा विश्वविद्यालय के पाठकों के द्वारा आवश्यकतानुसार आर्टिकल की मांग करते हैं तथा दूसरे विश्वविद्यालय द्वारा इस मांग की पूर्ति जेसीसी द्वारा किया जाता है।

3.8 ओजस (OJAS):- इसे इनफ्लिबनेट सेंटर द्वारा यूनिर्वसीटी को ओपन सोर्स डाटा बेस प्रदान किया गया है इसकी स्थापना लोक ज्ञान प्रोजक्ट के तहत किया गया। यंहा बिना किसी कीमत के विश्वविद्यालय एवं महाविद्यालय के छात्र–छात्राओं शिक्षक एवं पाठक इसका प्रयोग कर सकते है यह सुविधा शोध पत्रिका में प्रकाशित इलेक्ट्रानिक जनरल को एक्सेस करने की सुविधा देती है

3.9 ईपीजी पाठशाला (E PG-Pathshala):- सूचना और संचार और प्रौद्योगिकी (एनएमईआईसीटी) के माध्यम से शिक्षा पर राष्ट्रीय मिशन भारत में मानव संसाधन विकास मंत्रालय विकास (एमएचआरडी) मंत्रालय द्वारा भारत के सभी शिक्षार्थियो को गुणवत्ता शैक्षणिक सामाग्री प्रदान करने के उददेश्य से यह परियोजना की शुरूवात की गई । आईसीटी(एनएमई–आईसीटी) के माध्यम से शिक्षा के लिए राष्ट्रीय मिशन के तहत स्नातकोत्तर स्तर पर 77 विषयों में ई–सामाग्री के विकास के लिए यूजीसी को काम सौंपा है। ई–पीजी पाठ्शाला नामक इस पहल के तहत सामाजिक विज्ञान, कला, ललित कला, मानवविकास, प्राकृतिक विज्ञान, गणित भाषाविज्ञान में विभिन्न विषयों में उच्च गुणवत्ता आधारित आकर्षित पाठ्य सामग्री विकसित की गई है।

3.10 विद्वान डेटाबेस (Vidwan Database) :- विद्वान डेटाबेस, भारत के प्रमुख शैक्षिक संस्थानों और अन्य संगठन में काम कर रहे विषय वैज्ञानिकों एवं अन्य संकायों के सदस्यों का प्रोफाईल का डेटाबेस है। इस विद्वान डेटाबेस, में विशेषज्ञ की पृष्ठभूमि, संपर्क पता एवं अनुभव शामिल है एवं विद्वानों के शोध, प्रकाशन, कौशल और उपलब्धियों इत्यादि के बारे में महत्वपूर्ण जानकारी प्रदान करता है। इस डाटाबेस के माध्यम से छात्र–छात्राऐं एवं शोधार्थी अपने विषय से संबधित एवं शिक्षा में आने वाली समस्या पर प्रश्न कर समस्या का समाधान प्राप्त कर सकते है। आईसीटी एवं राष्ट्रीय शिक्षा मिशन के माध्यम से वित्तीय सहायता प्राप्त कर इनफ्लिबनेट द्वारा इस डेटाबेस को विकसित एवं रखरखाव किया जाता है।

3.11 अनुसंधान परियोजना (Research project database):- रिसर्च प्रोजेक्ट डेटाबेस भारत में विभिन्न विश्वविद्यालय में काम कर रहे विभिन्न संकाय सदस्यों के द्वारा चल रहे अनुसंधान परियोजनाओं का विवरण है। वर्तमान में इसमें विभिन्न फंड़िग एजेंसियों द्वारा 13600 से अधिक शोध परियोजना की जानकारी शामिल है जैसे कि यूजीसी आईसीएआर आईसीएआर आईसीएमआर डीएसटी और डीबीटी इत्यादि। परियोजना की जानकारी का विवरण परियोजना निदेशकों और वित्त एजेंसियों के द्वारा किया गया है।

3.12 विद्या–मित्रा (Vidya Mitra) :- विद्या–मित्रा एनएमई–आईसीटी (सूचना और संचार प्रौद्योगिकी शिक्षा राष्ट्रीय मिशन) एमएचआरडी के तहत विकसित सभी ई–सामग्री के लिए एक परियोजना ऑनलाइन शिक्षण पोर्टल है। यह पोर्टल सभी पाठ्य सामग्री को खोजने की सुविधा प्रदान करता है जिसमें छात्र एक ही इंटरफेस के माध्यम से ऑनलाइन पाठ्य सामाग्री ऑडियो/विडियो लर्निंग सामाग्री टेक्स्ट सामग्री मल्टीमीडिया सामग्री इत्यादि सहित वांछित सामग्री तक आसानी से पहुंच सकता है।

3.13 शोध-चक्र (ShodhChakra) :- शोध-चक्र विश्वविद्यालय अनुदान आयोग (यूजीसी) के मार्गदर्शन में सूचना और पुस्तकालय नेटवर्क (इनफ्लिबनेट) केंद्र की एक पहल हैए जो अकादमिक समुदाय को उनके शोध जीवन चक्र के दौरान मदद करती है। शोध-चक्र शोधकर्ताए मार्गदर्शक/पर्यवेक्षक और विश्वविद्यालय को एक शोध विद्वान के शोध जीवन चक्र का प्रबंधन करने के लिए एक अनूठा स्थान प्रदान करता है। यह एक डिजिटल कार्यक्षेत्र के रूप में काम करेगाए जिसमें शोधकर्ता अपने शोध कार्य को एकत्रए संग्रहीतए व्यवस्थित और उद्धृत कर सकते हैं। शोध-चक्र शोधकर्ताओं को अपनी प्रोफाइल बनाने और अपनी प्राथमिकताओं का प्रबंधन करने में मदद करेगा। पोर्टल का उपयोग करने की प्रक्रिया विश्वविद्यालय और इनफ्लिबनेट केंद्र के बीच एक समझौता ज्ञापन पर

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हस्ताक्षर करने के साथ शुरू होती है। विश्वविद्यालय/संस्थान को शोधकर्ता और पर्यवेक्षक की वैध जानकारी प्रदान करनी होगी। इसके अलावाए शोधकर्ता सिस्टम में लॉगिन कर सकते हैं और शोध-चक्र की सुविधाओं का लाभ उठा सकते हैं

3.14 ओनोस :- ONE NATION ONE SUBSCRIPTION (ONOS) भारत के प्रधानमंत्री ने 15 अगस्त, 2022 को लाल किले की प्राचीर से राष्ट्र के नाम अपने संबोधन में अमृत काल में हमारे देश में अनुसंधान और विकास के महत्व को इंगित किया था। उन्होंने इस अवसर पर "जय अनुसंधान" का स्पष्ट आह्वान किया था। राष्ट्रीय शिक्षा नीति, 2020 (एनईपी 2020) ने भी हमारे देश में उत्कृष्ट शिक्षा और विकास के लिए अनुसंधान को एक आवश्यक शर्त के रूप में पहचाना है। भारत को आत्मनिर्भर बनाने और विकसितभारत@2047 के दृष्टिकोण के जवाब में, भारत सरकार ने केंद्र सरकार और राज्य सरकारों और केंद्र सरकार के अनुसंधान और विकास संस्थानों द्वारा प्रबंधित सभी उच्च शिक्षा संस्थानों के छात्रों, शिक्षकों और शोधकर्ताओं को अंतरराष्ट्रीय उच्च प्रभाव वाले विद्वानों के शोध लेखों और जर्नल प्रकाशनों तक देशव्यापी पहुँच प्रदान करने के लिए वन नेशन वन सब्सक्रिप्शन योजना को मंजूरी दी। ONOS का उद्देश्य कई संस्थागत और संघ-आधारित सदस्यताओं को मिलाकर अधिकांश प्रमुख STEM और सामाजिक विज्ञान प्रकाशकों और सामग्री प्रदाताओं से ई-जर्नल/डेटाबेस सदस्यता के लिए राष्ट्रीय लाइसेंस प्राप्त करना है। ONOS के हिस्से के रूप में ओपन एक्सेस प्रकाशनों के लिए आर्टिकल प्रोसेसिंग शुल्क (APC) पर रियायतें भी प्रदान की गई हैं। "वन नेशन वन सब्सक्रिप्शन" के साथ भारत समावेशी शिक्षा और अनुसंधान के अपने दृष्टिकोण को प्राप्त करने की दिशा में एक महत्वपूर्ण छलांग लगाता है, यह सुनिश्चित करता है कि प्रत्येक व्यक्ति के पास सीखने, नवाचार करने और उत्कृष्टता प्राप्त करने के लिए उपकरण हों। यह पहल NEP के साथ संरेखित है और एक सशक्त और सूचित समाज बनाने की प्रतिबद्धता को रेखांकित करती है। ONOS का कार्यान्वयन, जिससे देश के विश्वविद्यालयों, कॉलेजों, अनुसंधान संगठनों सहित सभी शैक्षणिक और अनुसंधान एवं विकास संस्थानों को लाभ मिलने की उम्मीद है, चरणबद्ध तरीके से किया जाएगा।

पूर्ण-पाठ पत्रिकाओं के 30 प्रकाशकों का चयन किया गया है, जिन्हें कम से कम 10 पुस्तकालय संघों में से एक द्वारा सदस्यता दी गई है या वर्तमान लाभार्थी संस्थानों द्वारा स्वयं सदस्यता दी गई है। यह परिकल्पना की गई है कि पत्रिका प्रकाशकों से उनके द्वारा प्रकाशित पत्रिकाओं के पूर्ण संग्रह के लिए लाइसेंस प्राप्त किए जाएं। इसलिए पत्रिकाओं की संख्या बढ़कर लगभग 13,000 हो जाने की उम्मीद है। ई-संसाधनों तक सभी 6500 से अधिक सरकारी शैक्षणिक और अनुसंधान एवं विकास संस्थानों तक पहुंच का विस्तार करने की परिकल्पना की गई है, जो देश भर में 10 संघों में मौजूदा लाभार्थियों की संख्या का लगभग तीन गुना है। लाभार्थी उपयोगकर्ताओं की संख्या क्रमशः 2360 संस्थानों से 6500+ संस्थानों तक 56.7 लाख से 177.82 लाख तक बढ़ाई जाएगी।

3.15 कैलिबर (CALIBER):- कैलिबर 2025 सूचना पेशेवरों और ज्ञान प्रबंधकों को अपने क्षितिज का विस्तार करने और पेशेवर विशेषज्ञता को बढ़ाने का एक अनूठा अवसर प्रदान करता है। यह एक केंद्रित कार्यक्रम है जो एक महत्वपूर्ण विषय और उप-विषयों पर नवीनतम रुझानों को संबोधित करता है। कैलिबर दुनिया भर से पुस्तकालय और सूचना विज्ञान और कंप्यूटर विज्ञान के क्षेत्र में चिकित्सकों और शिक्षाविदों को एक साथ लाता है। इस कार्यक्रम में दुनिया भर के प्रमुख विशेषज्ञ, आईटी गुरु और विक्रेता भाग लेते हैं। कैलिबर देश भर और उससे बाहर के पुस्तकालयाध्यक्षों, सूचना विशेषज्ञों, प्रकाशकों के बीच रणनीतिक चर्चाओं को प्रोत्साहित करने के लिए प्रसिद्ध और ट्रेंड-सेटिंग वक्ताओं के लिए एक मंच साबित हुआ है।

कैलिबर एक अंतर्राष्ट्रीय सम्मेलन है जिसे इनफ्लिबनेट सेंटर द्वारा देश के विभिन्न हिस्सों में विश्वविद्यालयों के सहयोग से आयोजित किया जाता है, जो नीचे उल्लिखित सम्मेलन के विषयों और उप-विषयों से संबंधित शोध और तकनीकी कार्यों, केस स्टडी, प्रौद्योगिकी अपडेट आदि पर उच्च गुणवत्ता वाले पेपर आमंत्रित करता है। यह सम्मेलन पुस्तकालय और सूचना पेशेवरों, शिक्षकों, आईटी पेशेवरों, सलाहकारों और पुस्तकालयों के स्वचालन और नेटवर्किंग में शामिल उपयोगकर्ताओं के साथ-साथ सूचना प्रदाताओं को एक साथ आने और आपसी हित के विषयों पर बातचीत करने के लिए एक अनूठा मंच प्रदान करता है। 14वें अंतर्राष्ट्रीय कैलिबर का विषय है "पुस्तकालय 2047: विकसित भारत की दिशा में ज्ञान का लोकतंत्रीकरण"।

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3.16 आईआरआईएनएस (IRINS):- IRINS सूचना और पुस्तकालय नेटवर्क (INFLIBNET) केंद्र द्वारा विकसित वेब-आधारित अनुसंधान सूचना प्रबंधन (RIM) सेवा है। यह पोर्टल अकादमिक, अनुसंधान एवं विकास संगठनों और संकाय सदस्यों, वैज्ञानिकों को विद्वानों की संचार गतिविधियों को एकत्र करने, क्यूरेट करने और प्रदर्शित करने की सुविधा प्रदान करता है और विद्वानों का नेटवर्क बनाने का अवसर प्रदान करता है। IRINS भारत में शैक्षणिक और अनुसंधान एवं विकास संगठनों के लिए मुफ्त सॉफ्टवेयर-एज़-सर्विस के रूप में उपलब्ध है।

IRINS मौजूदा अनुसंधान प्रबंधन प्रणाली जैसे कि मानव संसाधन प्रणाली, पाठ्यक्रम प्रबंधन, अनुदान प्रबंधन प्रणाली, संस्थागत भंडार, खुले और वाणिज्यिक उद्धरण डेटाबेस, विद्वानों के प्रकाशकों आदि को एकीकृत करने में सहायता करेगा। इसने विभिन्न स्रोतों से विद्वानों के प्रकाशन को प्राप्त करने के लिए ORCID ID, ScopusID, अनुसंधान ID, Microsoft शैक्षणिक ID, Google विद्वान ID जैसी शैक्षणिक पहचान के साथ एकीकरण किया है।

3.17 ई-शोध सिंधु (E- Shodh sindhu):- विशेषज्ञ समिति की सिफारिश के आधार पर, मानव संसाधन विकास मंत्रालय (जिसे अब शिक्षा मंत्रालय का नाम दिया गया है) ने तीन संघ पहलों को मिलाकर ई-शोध सिंधु का गठन किया है, जिनके नाम हैं यूजीसी-इन्फोनेट डिजिटल लाइब्रेरी कंसोर्टियम, एनएलआईएसटी और इंडेस्ट-एआईसीटीई कंसोर्टियम। ई-शोध सिंधु यूजीसी अधिनियम की धारा 12(बी) और 2(एफ) के तहत आने वाले केंद्रीय वित्त पोषित तकनीकी संस्थानों, विश्वविद्यालयों और कॉलेजों सहित अपने सदस्य संस्थानों को बड़ी संख्या में प्रकाशकों और एग्रीगेटर्स से विभिन्न विषयों में 10,000 से अधिक कोर और समकक्ष-समीक्षित पत्रिकाओं और कई ग्रंथसूची, उद्धरण और तथ्यात्मक डेटाबेस तक वर्तमान और अभिलेखीय पहुंच प्रदान करना जारी रखेगा।

ई-शोध सिंधु: उच्च शिक्षा ई-संसाधनों के लिए कंसोर्टिया का मुख्य उद्देश्य शैक्षणिक संस्थानों को कम सदस्यता दरों पर पूर्ण-पाठ, ग्रंथ सूची और तथ्यात्मक डेटाबेस सहित गुणात्मक इलेक्ट्रॉनिक संसाधनों तक पहुँच प्रदान करना है। ई-शोध सिंधु के प्रमुख लक्ष्य और उद्देश्य इस प्रकार हैं: तीन एमएचआरडी-वित्त पोषित कंसोर्टिया द्वारा दी जाने वाली गतिविधियों और सेवाओं को बढ़ाने और मजबूत करने के द्वारा ई-शोध सिंधु: उच्च शिक्षा ई-संसाधनों के लिए कंसोर्टिया की स्थापना करना; सतत पहुँच के आधार पर ई-जर्नल, ई-जर्नल अभिलेखागार और ई-पुस्तकों का एक शानदार संग्रह विकसित करना; जागरूकता और प्रशिक्षण कार्यक्रमों के माध्यम से भारत में सदस्य विश्वविद्यालयों, कॉलेजों और तकनीकी संस्थानों में ई-संसाधनों के उपयोग की निगरानी और बढ़ावा देना; सभी शैक्षणिक संस्थानों को सदस्यता-आधारित विद्वानों की जानकारी (ई-पुस्तकें और ई-जर्नल) तक पहुँच प्रदान करना; विषय पोर्टल और विषय गेटवे के माध्यम से खुली पहुँच में उपलब्ध विद्वानों की सामग्री तक पहुँच प्रदान करना डिजिटल विभाजन को पाटना और सूचना-समृद्ध समाज की ओर बढ़ना

3.18 इन्फ़िड (INFID):- भारत में पहला फेडरेशन, इंडियन एक्सेस मैनेजमेंट फेडरेशन (आईएनएफईडी) ने कॉलेजों और विश्वविद्यालयों के अधिकृत उपयोगकर्ताओं को प्रमाणित करने और उन्हें कहीं से भी, कभी भी ई-संसाधनों तक निर्बाध पहुंच प्रदान करने के लिए मानक-आधारित ओपन सोर्स सॉफ्टवेयर शिबोलेथ को अपनाया है।

आईएनएफएलआईबीएनईटी केंद्र, अपने मुख्य अधिदेशों में से एक के रूप में, ई-शोध सिंधु के तहत भारत में विश्वविद्यालयों और कॉलेजों को विद्वानों के ई-संसाधन तक पहुंच प्रदान करता है। आईएनएफईडी को विशेषताओं के आदान-प्रदान के लिए मानकीकृत नियमों और मेटाडेटा का उपयोग करके भाग लेने वाले संस्थानों में वितरित उपयोगकर्ता प्रमाणीकरण और पहुंच नियंत्रण तंत्र के कार्यान्वयन की प्रक्रिया में सदस्य संस्थानों के साथ समन्वय करने के लिए एक केंद्रीकृत एजेंसी के रूप में स्थापित किया जा रहा है।

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3.19 शोध शुद्धि (Shodhsudhhi):- ई-शोध सिंधु की राष्ट्रीय संचालन समिति (एनएससी) की उप-समिति की सिफारिश के आधार पर, शिक्षा मंत्रालय, भारत सरकार ने 1 सितंबर, 2019 से भारत के सभी विश्वविद्यालयों/संस्थानों को साहित्यिक चोरी का पता लगाने वाले सॉफ़्टवेयर (पीडीएस) तक पहुँच प्रदान करने वाला एक कार्यक्रम "शोध शुद्धि" शुरू किया है। 1100 से अधिक संस्थानों की पहचान की गई है, जिनमें शामिल हैं -

1. केंद्रीय विश्वविद्यालय
2. राज्य विश्वविद्यालय
3. डीम्ड विश्वविद्यालय
4. निजी विश्वविद्यालय
5. केंद्र द्वारा वित्तपोषित तकनीकी संस्थान (सीएफटीआई)
6. यूजीसी के अंतर-विश्वविद्यालय केंद्र (आईयूसी)

शोध शुद्धि पहल के तहत, देश भर के विश्वविद्यालयों और संस्थानों को वेब-आधारित साहित्यिक चोरी का पता लगाने वाले सॉफ़्टवेयर सिस्टम ऑरिजिनल (पूर्व में उरकुंड) तक पहुँच प्रदान की गई। इस पहल का आधिकारिक उद्घाटन पूर्व शिक्षा मंत्री (पूर्व में एमएचआरडी) ने 21 सितंबर, 2019 को किया था, और यह तब तक जारी रहा जब तक कि टर्निटिन द्वारा मेसर्स ऑरिजिनल के साथ अनुबंध 30 सितंबर, 2023 को समाप्त नहीं हो गया। 1 अक्टूबर, 2023 से शुरू होकर, INFLIBNET केंद्र अब उसी शोधशुद्धि पहल के हिस्से के रूप में उच्च शिक्षा संस्थानों (HEI) को 'ड्रिलबिट-एक्सट्रीम प्लेगियरिज्म डिटेक्शन सॉफ्टवेयर' प्रदान करता है। इस सॉफ़्टवेयर का परीक्षण चरण अक्टूबर 2023 के लिए निर्धारित किया गया था, जिसकी पूर्ण सेवा 1 नवंबर, 2023 को शुरू हुई थी।

3.4 निष्कर्ष (Conclusion) :-

इनफिबनेट के द्वारा प्रदान की गई सेवा से भारत के विभिन्न पुस्तकालय एवं सूचना केंद्र सूचना को आसानी से प्रयोग कर रही है। इनफिबनेट से सदस्य पुस्तकालय से बहुत सारी सुविधा प्राप्त कर रही है। जैसे पुस्तकालय का बजट बढें बिना बहुत अधिक मात्रा में सूचना साहित्य को प्राप्त कर रही हैं। सूचना आदान प्रदान एवं लोन की सुविधा शोधर्थीयों एवं अन्य छात्रों के अपने शिक्षण एवं शोध सम्बधी इलेक्ट्रानिक सूचना देश विदेश की पाठ्य सामाग्री कुछ ही समय में डेटाबेस से प्राप्त हो जाती है। हमारे देश में उच्च शिक्षा इनफिबनेट की बहुत सारी सुविधा से आगे बढ़ रहा है। और भविष्य में इसके सहयोग एवं विकास से देश में उच्च शिक्षा का स्तर बढाने मे मदद मील रही है और मिलती रहेगी इनफिबनेट सूचना को आसानी से प्राप्त करने का एक आसान माध्यम है।

आधुनिक तकनीकों को एकीकृत करके और एक सहयोगी डिजिटल पारिस्थितिकी तंत्र बनाकर भारतीय शैक्षणिक और शोध संस्थानों में पुस्तकालय सेवाओं को बढ़ाने में महत्वपूर्ण भूमिका निभाता है। इसका एक प्रमुख योगदान ै्ल्स ;विश्वविद्यालय पुस्तकालयों के लिए सॉफ़्टवेयर) सॉफ़्टवेयर के माध्यम से पुस्तकालय स्वचालन हैए जो कैटलॉगिंगए संचलनए अधिग्रहण और सीरियल नियंत्रण को कुशलतापूर्वक प्रबंधित करने में मदद करता है। यूनियन कैटलॉग के निर्माण का भी समर्थन करता है जिससे पुस्तकालयों को ग्रंथसूची डेटा साझा करने और काम के दोहराव से बचने में मदद मिलती है।

शोधगंगा जैसे प्लेटफ़ॉर्म के माध्यम से पुस्तकालयों को देश भर के विद्वानों द्वारा प्रस्तुत शोध थीसिस और शोध प्रबंधों को संग्रहीत करने और उन तक खुली पहुँच प्रदान करने की अनुमति देता है। इसकी साहित्यिक चोरी का पता लगाने वाली सेवाए शोधशुद्धिए पुस्तकालयों और संकाय को शोध दस्तावेजों की जाँच करने में मदद करके अकादमिक अखंडता सुनिश्चित करती है। ई-शोधसिंधु के साथए पुस्तकालयों को इलेक्ट्रॉनिक पत्रिकाओं और डेटाबेस की एक विस्तृत श्रृंखला तक पहुँच प्राप्त होती हैए जिससे उपयोगकर्ताओं के लिए उपलब्ध जानकारी की गुणवत्ता और सीमा में सुधार होता है।

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इसके अतिरिक्तए ष्छथ्स्ठछम्ज संस्थागत रिपॉजिटरीए डिजिटल लाइब्रेरी और रिमोट एक्सेस सेवाओं का समर्थन करता हैए जिससे उपयोगकर्ता कभी भी और कहीं से भी जानकारी प्राप्त कर सकते हैं। कुल मिलाकरए इनफ्लिबनेट संसाधन साझाकरणए डिजिटल पहुंच और अनुसंधान सहायता को बढ़ावा देकर पुस्तकालय सेवाओं को महत्वपूर्ण रूप से मजबूत करता हैए इस प्रकार पारंपरिक पुस्तकालयों को गतिशील ज्ञान केंद्रों में परिवर्तित करता है।

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