

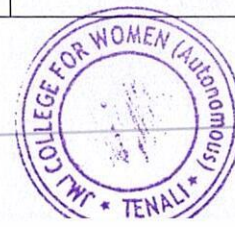
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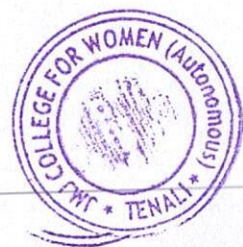
**2019 - 20**

2019-2020

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# A STUDY ON GOODS AND SERVICE TAX AND IT'S IMPACT ON INDIAN ECONOMY

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## ABSTRACT

*This study is intended to access the Impact of GST in India economy. This is the biggest tax reform that took place in India which was founded on the notion of "one nation, one market, one tax". The main objective of GST scheme is reforming the indirect tax and as well dismantling all the inter-state barriers with respect to trade. The study is going to examine how the reform process of the indirect tax started in India which gave birth to the current GST scheme we have today. The Objectives and benefits of the Goods and service tax will be stated in the study and a detailed description of how GST works and operate in India will be discussed. GST is known to be a type of Value added Tax which is imposed on various goods and services, with that, several countries impose it on goods and services in various forms, and the taxes charged on the goods and services differ amongst countries, in that case the study will discuss the main characteristics of GST in India. The study will also examine the advantages and disadvantages of implementing GST and also the impact of GST on the final consumer.*

**KEY WORDS:** *Indirect tax, GST, final consumer, India*

## INTRODUCTION

GST stands for Goods and Services Tax levied by the Government in a move to replace all of the indirect taxes. In India, the idea of GST was contemplated in 2004 by the Task Force on implementation of the Fiscal Responsibility and Budget Management Act, 2003, named Kelkar Committee. The Kelkar Committee was convinced that a dual GST system shall be able to tax almost all the goods and services and the Indian economy shall be able to have wider market of tax base, improve revenue collection through levying and collection of indirect tax and more pragmatic approach of efficient resource allocation. Under the Goods and Service Tax mechanism, every person is be liable to pay tax on output and shall be entitled to enjoy credit on input tax paid and tax shall be only on the amount of value added . The principal aim of GST is to eliminate cascading effect i.e. tax on tax and it will lead to bringing about cost competitiveness of the products and services both at the national and international market. GST System is built on integration of different taxes and is likely to give full credit for input taxes. GST is a comprehensive model of levying and collection of indirect tax in India and it has replace taxes levied both by the Central and State Governments. GST be levied and collected at each stage of sale or purchase of goods or services based on input tax credit method. Under this system, GST-registered commercial houses shall be entitled to claim credit of the tax they paid on purchase of goods and services as a part of their day to day businesses.

The historic GST or goods and services tax has become a reality. The new tax system was launched at a function in Central Hall of Parliament on 1st July ,2017 (Friday midnight). GST, which embodies the principle of "one nation, one tax, one market" is aimed at unifying the country's \$2 trillion economy and 1.3 billion people into a common market. Under GST, goods and services fall under five tax categories: 0 per cent, 5 per cent, 12 per cent, 18 per cent and 28 per cent. For corporates, the elimination of multiple taxes will improve the ease of doing business. And for consumers, the biggest advantage would be in terms of a reduction in the overall tax burden on goods. "Inflation will come down, tax avoidance will be difficult, India's GDP will be benefitted and extra resources will be used for welfare of poor and weaker section," Finance Minister Arun Jaitley said at GST launch event in Parliament. The Lok Sabha has finally Passed the Goods and Services Tax Bill and it is expected to have a significant impact on every industry and every consumer. Apart from filling the loopholes of the current system, it is also aimed at boosting the Indian economy. This will be done by simplifying and unifying the indirect taxes for all states throughout India.

## II. Research Methodology

The research paper is based on empirical study. It is a type of descriptive research paper. **Objectives of Study:**

1. The first objective of the paper is to highlight the impact of GST on Indian Economy.
2. The second objective is to explain advantages and disadvantages of GST in India.

### Importance of the Study:

1. The study will highlight the effect of GST on Indian Economy.
2. It will prove to be of great help to a common man to understand the concept the GST.
3. It will remove the morbid fear of GST from among the business community members.

**Data Collection:** This paper is a descriptive paper based on secondary data collected from different books , news-paper articles and research journals.

### Need for Goods and Service Tax:

1. The main reason behind introducing GST is to improve the economy of the nation.
2. VAT rates and regulations differ from state to state. And it has been observed that states often resort to slashing these rates for attracting investors. This results in loss of revenue for both the Central as well as State government.
3. On the other hand, GST brings in uniform tax laws across all the states spanning across diverse industries. Here, the taxes would be divided between the Central and State government based on a predefined and pre-approved formula. In addition, it would become much easier to offer services and goods uniformly across the nation, since there won't be any additional state-levied tax.

4. GST rollout missed several deadlines due to disagreement among many states over certain important issues on the new tax reform. However GST is scheduled for a nation-wide rollout on July 1st, 2017.

#### Features of GST

1. GST is one indirect tax for the entire nation, which will make India “one unified common market”.
2. It will replace multiple taxes like VAT, CST, Excise Duty, Entry Tax, Octroi, LBT, Luxury Tax etc.
3. There are four types of GST namely:
  - a) SGST – State GST, collected by the State Govt.
  - b) CGST – Central GST, collected by the Central Govt.
  - c) IGST – Integrated GST, collected by the Central Govt.
  - d) UTGST – Union Territory GST, collected by the Union Territory
4. Tax Payers with an aggregate turnover in a financial year up [ Rs. 20 Lakhs & Rs. 10 Lakhs for North Eastern States and Special Category States] would be exempted from tax.
5. GST slabs are pegged at 5%, 12%, 18% & 28%.

#### Impact of GST in India : Positive Impact of GST in India:

1. GST is a single taxation system that will reduce the number of indirect taxes. From now, a single taxation term would cover all of those indirect taxes.
2. The prices of products and services would reduce, thus this system would prove to be beneficial for the people who are fed up of paying high prices.
3. This would reduce the burden from the state and the central government. With the introduction of GST, all indirect taxes would come under a single roof.
4. GST would not be charged at every point of sale like other indirect taxes so in this way, market would be developed.
5. Corruption-free taxation system. GST would introduce corruption-free taxation system.
6. For consumers, it will be a mixed bag as some goods become cheaper while others will be expensive.
7. Removes cascading effect of taxes.
8. Manufacturing costs will be reduced, hence prices of consumer goods likely to come down.
9. Due to reduced costs some products like cars, FMCG etc. will become cheaper.
10. A unified tax regime will lead to less corruption which will indirectly affect the common man.

#### Negative Impact of GST in India:

- The introduction of GST in the country will impact real estate market. This would increase new home buying price by 8% and reduce buyers’ market by 12%.

- GST is a mystifying term where double tax is charged in the name of a single tax.
- Most of the dealer's don't pay central excise tax and cheat the government by simply giving the VAT. But all of those dealers would now be forced to pay GST.
- The short-term impact of GST is expected to be neutral-to negative for the broader economy.
- Production processes are likely to take some time to align with the new framework as firms adjust to the input tax credit system and better manage working capital requirements.
- For consumers, it will be a mixed bag as some goods become cheaper while others will be expensive.
- Services will become expensive e.g. Telecom, banking, airline etc.
- Being a new tax, it will take some time for the people to understand its implications.
- It is easier said than done. There are always some complications attached. It is a consumption based tax, so in case of services the place where service is provided needs to be determined.
- If actual benefit is not passed to consumer and seller increases his profit margin, the prices of goods can also see a rising trend.

However, GST is a long term strategy and the positive impact shall be seen in the long run only. Let us hope GST proves to be a game changer in a positive way and proves to be beneficial to the common man.

### IMPACT OF GST IN INDIA

It is expected that the creation of the Goods and Service Tax act and its implementation will have a great impact on various aspects of business in India by changing the traditional pattern of pricing the products and services. The Goods and Service Act will also have a great impact on the tax system in India by reducing the unfavorable effect of tax on the cost of goods and services. GST is expected to change the whole indirect tax system by impacting the tax structure, tax computation, credit utilization and tax frequency. It will also help in supply chain optimization. . It will help in creating a single national market by merging several Central and State taxes under a one single tax procedure. The tax rate under GST are set at 0%, 5%, 12%, 18% and 28% for various goods and services, and almost 50% of goods & services comes under 18% tax rate. Let's now examine how GST on some day-to-day good and services will have an impact on the final consumer.

1. **Mobile Bills:** People will have to pay more on mobile phone bills as GST on telecom services is now 18%, as opposed to the earlier tax rate of 15%. However, telecom companies may absorb this 3% rise due to stiff competition.

2. **Footwear & Apparels/Garments:** Footwear costing more than INR 500 will have a GST rate of 18% from an earlier rate of 14.41% rate but rates for the footwear below INR 500 has been reduced to 5%. So, one will spend more in purchasing a footwear above INR 500/-. And with respect to the ready-made



garments, the rates have been reduced to 12% from an existing rate of 18.16% which will make the goods cheaper.

3. **Cab and Taxi rides:** Taking an Ola or an Uber now will be cheaper because the tax rate has fallen to 5% from an earlier 6% for a cab booking made online.

4. **Airline tickets:** Under the GST, tax rate for economy class for flight tickets is set at 5% but the tax for business class tickets will have a higher tax rate of 12%.

5. **Train Fare:** In the case of the train fare, there will be no much impact because the effective tax rate has increased from 4.5% to 5% in GST. But, passengers who travel for business trips can claim Input Tax Credit on their rail ticket which can help them to reduce expenses. People travelling by local trains or in the sleeper class will not be affected, but first-class & AC travelers will have to pay more.

6. **Movie Tickets:** Movies tickets costing below INR 100 will be charged a GST rate of 18% but prices above INR 100 will have a higher tax rate of 28%.

7. **Life Insurance Premium:** The Premium Amounts on policies will rise; with an immediate impact which can be seen on the term and endowment policy premiums as the rates have been increased under GST across life, health and general insurance.

8. **Jewellery:** The gold investment will become slightly expensive because there will be 3% GST on gold & 5% on the making charges. The earlier tax rate on gold was around 2% in most of the states and the GST is increased from the existing rate to around 2% to 3%.

9. **Property:** Under construction properties will be cheaper than ready-to-move-in properties. GST rate for an under-construction property is 18% but the effective rate on this kind of property will be around 12% due to input tax credits the builder will avail off.

10. **Education & Medical Facilities:** Education and Medical sectors have been kept outside the GST scope and both the primary education & healthcare is exempted from GST. It means a consumer will not pay any tax for the money spent on these services. But due to increase in tax rates for certain goods & services as procured by these organizations, they may pass on the additional tax burden to the consumers.

11. **Hotel services:** For any hotel stay, if a room tariff is less than Rs 1,000, there will be no GST, but anything above Rs 5,000 will attract 28% tax.

12. **Car purchase:** Most of the cars in the Indian market will become slightly cheaper, except for the hybrid cars because the GST rate will be 28% tax on all the vehicles irrespective of their make, engine capacity or model. However, over and above this 28%, an additional cess will be levied which can be either 1%, 3% or 15 %, depending on the particular car segment.

13. **Restaurant Bills:** This will depend on whether one dined at an AC or Non-AC establishments which do not serve alcohol. Now dining at five-star hotels will be charged at 18% GST rate and the Non-AC restaurants will be charged 12% and a 5% GST will be charged from small hotels, dhabas and restaurants that do not cross an annual turnover of INR 50 Lakh.

14. **IPL & other related events:** Events like IPL i.e. sporting events will have a 28% GST rate which is higher than the earlier 20%. rates. Hence, this will increase the ticket price. And the GST rate for other

events like theatre, circus or Indian classical music shows or a folk dance performance or a drama show will be at 18% GST rate, this is lesser than the earlier tax rate.

**15. DTH and cable services:** The amount paid for DTH (Direct-To-Home) connections or to cable operators will reduce a bit as the rate is fixed at 18%, which is lower than the earlier taxes which were comprising of entertainment tax in the range of 10% to 30%, apart from the service tax of 15%.

**16. Amusements Parks:** The ticket price for amusement parks and theme parks will increase as the earlier service tax of 15% will become 28% under the GST.

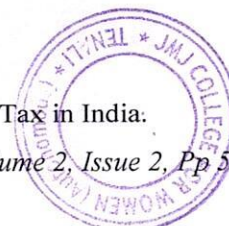
There is no doubt, the implementation of GST will take time, but it is likely to create more employment opportunities and economic inclusion. After a lot of deliberation, the GST council finalized the rates for all the goods and major service categories under various tax slabs, and the GST is expected to fill the loopholes in the current system and boost the Indian economy. This is being done by unifying the indirect taxes for all states throughout India.

### CONCLUSION

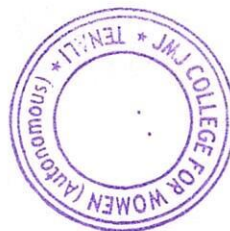
Introduction of GST is the most reasonable step taken towards the reform of indirect tax in India since its independence. It is imposed on all supply of goods and provision of services as well combination of all. Other sectors of economy be it the industry, business, and service sector shall have to bear the impact of GST, and those sectors such as the small and medium scale enterprises, intermediaries, importers, exporters, traders, professionals and consumers shall be directly affected by GST. This is one of the greatest taxation reforms in India, and is all set to integrate State economies and boost overall growth and development. GST will create a single, unified Indian market to make the economy stronger. However, experts say that GST is likely to improve tax collections and boost India's economic development by breaking tax barriers between States and integrating India through a uniform tax rate. Under the GST scheme, taxation burden will be divided equally between manufacturing and services, through a lower tax rate by increasing the tax base and minimizing exemptions.

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# The analysis of the M/M/1 queue with two vacation policies using pentagonal fuzzy numbers

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## Abstract

This study investigates the analysis of the M/M/1 queue with two vacation policies and Fuzzy parameters (FM/FM/1/SWV+MV). For this fuzzy queuing model, the researcher obtains some performance measure of interest such as the server is in the working vacation period, server is in the vacation period, the server is in the regular service period. Finally, numerical results are presented using pentagonal fuzzy numbers to show the effects of system parameters.

## Keywords

FM/FM/S model, membership values, pentagonal fuzzy numbers.

## AMS Subject Classification

68M20, 90B22.

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## Contents

1	Introduction .....	526
2	The crisp model .....	527
3	The model in fuzzy environment .....	527
4	Performance measure of interest .....	528
5	Numerical study .....	529
6	Conclusion .....	530
	References .....	531

## 1. Introduction

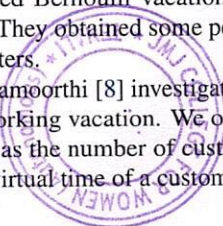
In 2002, Servi and Finn [15] introduced a class of semi-vacation, called working vacation, during which the customers are served with a lower rate rather than completely stopping serving. And they first analyzed an M/M/1 queue with this class of semi-vacation policy, denoted by M/M/1/WV, and obtained the PGF of the queue length and the LST of the sojourn time of a customer in steady state and applied their results to analyses a WDM optical access network using multiple wavelengths which can be reconfigured. Subsequently, Liu et al. [11] studied the M/M/1 queue with working vacations by matrix-geometric solution and established the stochastic decomposition structures of the queue length and sojourn time of a customer in steady state. Later, by the same method, Tian and Zhao [16] analyzed the M/M/1 queue with single working

vacation, denoted by M/M/1/SWV, and various indicators in steady state were derived.

On the M/G/1-type queue with working vacations, Wu and Takagi [17] studied the M/G/1 queue with working vacations based on the Laplace–Stieltjes transform method. Using the results in systems with disasters, Kim et al. [10] gave an analysis on the M/G/1 queue with exponential working vacations. By the method of matrix analysis, Baba [1] first investigated a GI/M/1-type queue with multiple working vacations utilizing the method of matrix analysis. Subsequently, Liu and Tian [11] analyzed the GI/M/1 queue with single working vacation. For a finite-buffer GI/M/1-type queue with multiple working vacations, we can see the survey of Banik et al. [2]. In contrast to the queuing model in above references, in which the exhaustive discipline has been applied.

R.Kalayanaraman et.al [3] introduced a single server vacation queue with fuzzy service time and vacation time distributions with some performance measures. R.Kalyanaraman, et.al [4, 5] gave a single server fuzzy queue with group arrivals and server vacation. R.Kalyanaraman, et.al [6] investigated a fuzzy bulk queue with modified Bernoulli vacation and restricted admissible customers. They obtained some performance measures in fuzzy parameters.

G. Kannadasan and N. Sathiyamoorthi [8] investigate the FM/FM/1 queue with single working vacation. We obtain some system characteristic such as the number of customer in the system in study-state, the virtual time of a customer in



the system, the server is in idle period, the server is in regular busy period. G. Kannadasan, et.al [8] also gave analysis for the FM/FM/1 queue with multiple working vacation with N-Policy, using non-linear programming method, with mean queue length, mean waiting time, at N=2. G.Kannadasan and N. Sathiyamoorthi [7] established the FM<sup>x</sup>/FM/1 queue with multiple working vacation and some performance measure of interest. G.Kannadasan and N.Sathiyamoorthi [9] worked in fuzzy analysis technique in the FM/FM/1 queue with single working vacation and set-up times.

In this paper, we analysis of the FM/FM/1 queue with two vacation policies (FM/FM/1/SWV+MV). In section 2, we describe the queue model. In section 3 and 4, we discuss the fuzzy model the server is in the working vacation period, server is in the vacation period, the server is in the regular service period are studied in fuzzy environment respectively. In section 5 includes numerical study about the performance measures.

### 2. The crisp model

The queuing model we consider here is defined explicitly as follows:

- (1) Customers arrive to the system according to the Poisson process with rate  $\lambda$ , and service times in a regular service period are exponential distribution with mean  $\mu_b^{-1}$ .
- (2) The working vacation is a class of semi-vacation policy during which the customers arriving are served at a lower service rate  $\mu_v (\mu_v < \mu_b)$ , rather than completely stopping service as that the server is in the working vacation period.
- (3) The durations of the working vacations are exponential distributions with mean  $\theta_w^{-1}$  and the durations of the vacations are exponential distributions with mean  $\theta_v^{-1}$ .
- (4) The two vacation policies are described as follows: After a regular service period, the server starts to take a working vacation. At the working vacation completion epoch, if there are customers left in the system, the server will change the service rate from  $\mu_v$  to  $\mu_b$ , and another regular service period will start. Otherwise, the system chooses to enter into a vacation. If there are customers staying the queue when a vacation completes, the server is resumed to a regular service period. Otherwise, the server continues the vacations until there are arrivals in the system at the vacation completion epoch, and a regular service period will start.
- (5) The inter-arrival times, service times in regular service period, service times in working vacation period, working vacation times and vacation times are all assumed to be mutually independent. In addition, the service discipline is First Come First Served.

### 3. The model in fuzzy environment

In this section the arrival rate, regular service rate, lower service rate, vacation rate and working vacation rate are assumed to be fuzzy numbers  $\tilde{\lambda}, \tilde{\beta}_1, \tilde{\beta}_2, \tilde{\theta}_1, \tilde{\theta}_2$

respectively. Now

$$\begin{aligned} \tilde{\lambda} &= \{x, \mu_{\tilde{\lambda}}(x); x \in S(\tilde{\lambda})\}, \\ \tilde{\beta}_1 &= \{y_1, \mu_{\tilde{\beta}_1}(y_1); y_1 \in S(\tilde{\beta}_1)\}, \\ \tilde{\beta}_2 &= \{y_2, \mu_{\tilde{\beta}_2}(y_2); y_2 \in S(\tilde{\beta}_2)\}, \\ \tilde{\theta}_1 &= \{z_1, \mu_{\tilde{\theta}_1}(z_1); z_1 \in S(\tilde{\theta}_1)\} \text{ and} \\ \tilde{\theta}_2 &= \{z_2, \mu_{\tilde{\theta}_2}(z_2); z_2 \in S(\tilde{\theta}_2)\}. \end{aligned}$$

Where  $S(\tilde{\lambda}), S(\tilde{\beta}_1), S(\tilde{\beta}_2), S(\tilde{\theta}_1)$  and  $S(\tilde{\theta}_2)$  are the universal set's of arrival rate, regular service rate, lower service rate, vacation rate and working vacation rate respectively. Define  $f(x, y_1, y_2, z_1, z_2)$  as the system performance measure related to the above defined fuzzy queuing model which depends on the fuzzy membership function  $f(\tilde{\lambda}, \tilde{\beta}_1, \tilde{\beta}_2, \tilde{\theta}_1, \tilde{\theta}_2)$ . Applying Zadeh's extension principle (1978) the membership function of the performance measure  $f(\tilde{\lambda}, \tilde{\beta}_1, \tilde{\beta}_2, \tilde{\theta}_1, \tilde{\theta}_2)$  can be defined as,

$$\begin{aligned} &\mu_{\tilde{f}(\tilde{\lambda}, \tilde{\beta}_1, \tilde{\beta}_2, \tilde{\theta}_1, \tilde{\theta}_2)}(D) \\ &= \sup_{\substack{x \in S(\tilde{\lambda}) \\ y_1 \in S(\tilde{\beta}_1) \\ y_2 \in S(\tilde{\beta}_2) \\ z_1 \in S(\tilde{\theta}_1) \\ z_2 \in S(\tilde{\theta}_2)}} \left\{ \mu_{\tilde{\lambda}}(x), \mu_{\tilde{\beta}_1}(y_1), \mu_{\tilde{\beta}_2}(y_2), \mu_{\tilde{\theta}_1}(z_1), \mu_{\tilde{\theta}_2}(z_2) \right\} \\ & \quad / D = f(x, y_1, y_2, z_1, z_2) \end{aligned}$$

If the  $\alpha$ - cuts of  $f(\tilde{\lambda}, \tilde{\beta}_1, \tilde{\beta}_2, \tilde{\theta}_1, \tilde{\theta}_2)$  degenerate to some fixed value, then the system performance is a crisp number, otherwise it is a fuzzy number.

**The server is in the working vacation period**

$$\begin{aligned} P_0 &= \sum_{k=0}^{\infty} \pi_{k0} = K \frac{1}{1-r}, \\ P_0 &= K \left( \frac{2\mu_v - (A)}{2\mu_v} \right). \end{aligned}$$

Where,

$$A = \lambda + \theta_w + \mu_v - \sqrt{(\lambda + \theta_w + \mu_v)^2 - 4\lambda\mu_v}.$$

and,

$$\begin{aligned} K &= \frac{2\mu_v - A}{2\mu_v} \left( \frac{\theta_v\mu_b - \lambda\theta_v}{\lambda\mu_b + \theta_v\mu_b} \right) \left[ \left( \frac{\theta_v\mu_b - \theta_v\lambda}{\lambda\mu_b + \theta_v\mu_b} \right) \right. \\ &+ \left. \left( \frac{2\mu_v - A}{2\mu_v} \right) \left( \frac{\theta_w\mu_b - \theta_w\lambda}{\mu_b\lambda} \right) + \frac{2\theta_w\mu_v - A\theta_w}{2\mu_v\mu_b} \right. \\ &+ \left. \left( \frac{\theta_w\theta_v A}{2\lambda\mu_v + 2\mu_v\theta_v} \right) \left( \frac{2\mu_v}{2\mu_v\mu_b - A\mu_b} \right) \right]^{-1}, 0 < r < 1 \end{aligned}$$

**The server is in the vacation period**

$$P_1 = \sum_{n=1}^{\infty} \pi_{k1} = K \frac{\theta_w}{\lambda} \frac{1}{1-\beta},$$

$$P_1 = \sum_{n=1}^{\infty} \pi_{k1} = K \frac{\theta_w}{\lambda} \left( \frac{\lambda + \theta_v}{\theta_v} \right)$$

**The server is in the regular service period**

$$P_2 = \sum_{k=1}^{\infty} \pi_{k2} = K \left[ \frac{\theta_w r}{\mu_b(1-r)^2(1-\rho)} \frac{\theta_w}{\mu_b(1+\beta)(1-\rho)} \right],$$



$$P_2 = K \left[ \frac{2A\theta_w\mu_v}{(2\mu_v - A)^2(\mu_b - \lambda)} + \frac{\theta_w(\lambda\mu_b + \theta_v\mu_b)}{\mu_b(\theta_v\mu_b - \lambda\theta_v)} \right]$$

We obtain the membership function of some performance measures namely the server is in the working vacation period, the server is in the vacation period, the server is in the regular service period for the system in terms of this membership function are, as follows:

$$\mu_{\overline{P}_0}(B) = \sup_{\substack{x \in S(\lambda) \\ y_1 \in S(\beta_1) \\ y_2 \in S(\beta_2) \\ z_1 \in S(\theta_1) \\ z_2 \in S(\theta_2)}} \{ \mu_{\lambda}(x), \mu_{\beta_1}(y_1), \mu_{\beta_2}(y_2), \mu_{\theta_1}(z_1), \mu_{\theta_2}(z_2) / B \}, \tag{3.1}$$

Where,  $B = K \left( \frac{2y_2 - A}{2y_2} \right)$ , and,

$$K = \frac{2y_2 - A}{2y_2} \left( \frac{z_1y_1 - xz_1}{xy_1 + z_1y_1} \right) \left[ \left( \frac{z_1y_1 - xz_1}{xy_1 + z_1y_1} \right) + \left( \frac{2y_2 - A}{2y_2} \right) \right. \\ \left. \left( \frac{z_2y_1 - xz_1}{xy_1} \right) + \left( \frac{2y_2z_2 - Az_2}{2y_1y_2} \right) + \left( \frac{y_2z_2A}{2(xy_2 + y_2z_1)} \right) \right. \\ \left. \left( \frac{2y_2}{2y_1y_2 - Ay_1} \right) \right]^{-1}$$

Where,

$$A = x + z_2 + y_2 - \sqrt{(x + z_2 + y_2)^2 - 4xy_2}$$

$$\mu_{\overline{P}_1}(C) = \sup_{\substack{x \in S(\lambda) \\ y_1 \in S(\beta_1) \\ y_2 \in S(\beta_2) \\ z_1 \in S(\theta_1) \\ z_2 \in S(\theta_2)}} \{ \mu_{\lambda}(x), \mu_{\beta_1}(y_1), \mu_{\beta_2}(y_2), \mu_{\theta_1}(z_1), \mu_{\theta_2}(z_2) / C \}, \tag{3.2}$$

Where,

$$C = K \frac{z_2}{x} \left( \frac{x + z_1}{z_1} \right)$$

$$\mu_{\overline{P}_2}(D) = \sup_{\substack{x \in S(\lambda) \\ y_1 \in S(\beta_1) \\ y_2 \in S(\beta_2) \\ z_1 \in S(\theta_1) \\ z_2 \in S(\theta_2)}} \{ \mu_{\lambda}(x), \mu_{\beta_1}(y_1), \mu_{\beta_2}(y_2), \mu_{\theta_1}(z_1), \mu_{\theta_2}(z_2) / D \}, \tag{3.3}$$

Where,

$$D = K \left[ \frac{2Ay_2z_2}{(2y_2 - A)^2(y_1 - x)} + \frac{z_2(xy_1 + y_1z_1)}{y_1(y_1z_1 - xz_1)} \right]$$

Using the fuzzy analysis technique explain, we can find the membership of  $\overline{P}_0$ ,  $\overline{P}_1$  and  $\overline{P}_2$  as a function of the parameter  $\alpha$ . Thus the  $\alpha$ -cut approach can be used to develop the membership function of  $\overline{P}_0$ ,  $\overline{P}_1$  and  $\overline{P}_2$ .

### 4. Performance measure of interest

The following performance measure are studied for this model in fuzzy environment.

#### The server is in the working vacation period

Based on Zadeh's extension principle,  $\mu_{\overline{P}_0}(B)$  is the supremum of minimum over

$$\left\{ \mu_{\lambda}(x), \mu_{\beta_1}(y_1), \mu_{\beta_2}(y_2), \mu_{\theta_1}(z_1), \mu_{\theta_2}(z_2) \right\} \\ : B = f(x, y_1, y_2, z_1, z_2) \text{ to satisfying} \\ \mu_{\overline{P}_0}(B) = \alpha, \quad 0 < \alpha \leq 1.$$

The following five case arise:

- Case(i) :  $\mu_{\lambda}(x) = \alpha, \mu_{\beta_1}(y_1) \geq \alpha, \mu_{\beta_2}(y_2) \geq \alpha, \mu_{\theta_1}(z_1) \geq \alpha, \mu_{\theta_2}(z_2) \geq \alpha,$
- Case(ii) :  $\mu_{\lambda}(x) \geq \alpha, \mu_{\beta_1}(y_1) = \alpha, \mu_{\beta_2}(y_2) \geq \alpha, \mu_{\theta_1}(z_1) \geq \alpha, \mu_{\theta_2}(z_2) \geq \alpha,$
- Case(iii) :  $\mu_{\lambda}(x) \geq \alpha, \mu_{\beta_1}(y_1) \geq \alpha, \mu_{\beta_2}(y_2) = \alpha, \mu_{\theta_1}(z_1) \geq \alpha, \mu_{\theta_2}(z_2) \geq \alpha,$
- Case(iv) :  $\mu_{\lambda}(x) \geq \alpha, \mu_{\beta_1}(y_1) \geq \alpha, \mu_{\beta_2}(y_2) \geq \alpha, \mu_{\theta_1}(z_1) = \alpha, \mu_{\theta_2}(z_2) \geq \alpha,$
- Case(v) :  $\mu_{\lambda}(x) \geq \alpha, \mu_{\beta_1}(y_1) \geq \alpha, \mu_{\beta_2}(y_2) \geq \alpha, \mu_{\theta_1}(z_1) \geq \alpha, \mu_{\theta_2}(z_2) = \alpha.$

For case (i), the lower and upper bound of  $\alpha$ - cuts of  $\overline{P}_0$  can be obtained through the corresponding parametric non-linear programs,

$$[\overline{P}_0]_{\alpha}^{L_1} = \min_{\Omega} \left\{ \left[ K \left( \frac{2y_2 - A}{2y_2} \right) \right] \right\}$$

and

$$[\overline{P}_0]_{\alpha}^{U_1} = \max_{\Omega} \left\{ \left[ K \left( \frac{2y_2 - A}{2y_2} \right) \right] \right\}.$$

Similarly, we can calculate the lower and upper bounds of the  $\alpha$ -cuts of  $\overline{P}_0$  for the case (ii), (iii), (iv) and (v).

By considering the cases, simulatuosly the lower and upper bounds of the  $\alpha$ -cuts of  $\overline{P}_0$  can be written as,

$$[\overline{P}_0]_{\alpha}^L = \min_{\Omega} \left\{ \left[ K \left( \frac{2y_2 - A}{2y_2} \right) \right] \right\}$$

and

$$[\overline{P}_0]_{\alpha}^U = \max_{\Omega} \left\{ \left[ K \left( \frac{2y_2 - A}{2y_2} \right) \right] \right\}.$$

such that

$$x_{\alpha}^L \leq x \leq x_{\alpha}^U, y_{1\alpha}^L \leq y_1 \leq y_{1\alpha}^U, y_{2\alpha}^L \leq y_2 \leq y_{2\alpha}^U, \\ z_{1\alpha}^L \leq z_1 \leq z_{1\alpha}^U, z_{2\alpha}^L \leq z_2 \leq z_{2\alpha}^U.$$

If both  $(\overline{P}_0)_{\alpha}^L$  and  $(\overline{P}_0)_{\alpha}^U$  are invertible with respect to  $\alpha$ , the left and right shape function,  $L(B) = [(\overline{P}_0)_{\alpha}^L]^{-1}$  and  $R(B) = [(\overline{P}_0)_{\alpha}^U]^{-1}$  can be derived from which the membership function  $\mu_{\overline{P}_0}(B)$  can be constructed as

$$\mu_{\overline{P}_0}(B) = \begin{cases} L(B), & (P_0)_{\alpha=0}^L \leq B \leq (P_0)_{\alpha=0}^U \\ 1, & (P_0)_{\alpha=1}^L \leq B \leq (P_0)_{\alpha=1}^U \\ R(B), & (P_0)_{\alpha=1}^L \leq B \leq (P_0)_{\alpha=0}^U \end{cases} \tag{4.1}$$



In the same way as we said before we get the following results.

**The server is in the vacation period**

$$\mu_{\bar{P}_1}(C) = \begin{cases} L(C), & (P_1)_{\alpha=0}^L \leq C \leq (P_1)_{\alpha=0}^U \\ 1, & (P_1)_{\alpha=1}^L \leq C \leq (P_1)_{\alpha=1}^U \\ R(C), & (P_1)_{\alpha=1}^L \leq C \leq (P_1)_{\alpha=0}^U \end{cases} \quad (4.2)$$

**The server is in the regular service period**

$$\mu_{\bar{P}_2}(D) = \begin{cases} L(D), & (P_2)_{\alpha=0}^L \leq D \leq (P_2)_{\alpha=0}^U \\ 1, & (P_2)_{\alpha=1}^L \leq D \leq (P_2)_{\alpha=1}^U \\ R(D), & (P_2)_{\alpha=1}^L \leq D \leq (P_2)_{\alpha=0}^U \end{cases} \quad (4.3)$$

**5. Numerical study**

**The server is in the working vacation period**

Suppose the arrival rate  $\bar{\lambda}$ , regular service rate  $\bar{\beta}_1$ , lower service rate  $\bar{\beta}_2$ , vacation time  $\bar{\theta}_1$  and working vacation rate  $\bar{\theta}_2$  are assumed to be Pentagonal fuzzy numbers described by:  $\bar{\lambda} = [1, 2, 3, 4, 5]$ ,  $\bar{\beta}_1 = [6, 7, 8, 9, 10]$ ,  $\bar{\beta}_2 = [11, 12, 13, 14, 15]$ ,  $\bar{\theta}_1 = [16, 17, 18, 19, 20]$  &  $\bar{\theta}_2 = [21, 22, 23, 24, 25]$  per hours respectively.

Then,

$$\lambda(\alpha) = \min_{x \in s(\bar{\lambda})} \{x \in s(\bar{\lambda}), G(x) \geq \alpha\}, \max_{x \in s(\bar{\lambda})} \{x \in s(\bar{\lambda}), G(x) \geq \alpha\}.$$

where

$$G(x) = \begin{cases} 0, & \text{if } x \leq a_1 \\ 1 - (1-r) \frac{x-a_2}{a_3-a_2}, & \text{if } a_2 \leq x \leq a_3 \\ 1, & \text{if } x = a_3 \\ 1 - (1-r) \frac{a_4-x}{a_4-a_3}, & \text{if } a_3 \leq x \leq a_4 \\ r \frac{a_5-x}{a_5-a_4}, & \text{if } a_4 \leq x \leq a_5 \\ 0, & \text{if } x \geq a_5 \end{cases}$$

(i.e.),

$$\lambda(\alpha) = [1 + \alpha, 5 - \alpha], \beta_1(\alpha) = [6 + \alpha, 10 - \alpha], \beta_2(\alpha) = [11 + \alpha, 15 - \alpha], \theta_1(\alpha) = [16 + \alpha, 20 - \alpha] \text{ \& } \theta_2(\alpha) = [21 + \alpha, 25 - \alpha].$$

It is clear that, when  $x = x_{\alpha}^U, y_1 = y_{1\alpha}^U, y_2 = y_{2\alpha}^U, z_1 = z_{1\alpha}^U$ , &  $z_2 = z_{2\alpha}^U$   $B$  attains its maximum value and when  $x = x_{\alpha}^L, y_1 = y_{1\alpha}^L, y_2 = y_{2\alpha}^L, z_1 = z_{1\alpha}^L$  &  $z_2 = z_{2\alpha}^L$   $B$  attains its minimum value.

From the generated for the given input value of  $\bar{\lambda}, \bar{\beta}_1, \bar{\beta}_2, \bar{\theta}_1$  &  $\bar{\theta}_2$ .

- i) For fixed values of  $x, y_1, y_2$  &  $z_1$ ,  $B$  decreases as  $z_2$  increase.
- ii) For fixed values of  $y_1, y_2, z_1$  &  $z_2$ ,  $B$  decreases as

- $x$  increase.
- iii) For fixed values of  $y_2, z_1, z_2$  &  $x$ ,  $B$  decreases as  $y_1$  increase.
- iv) For fixed values of  $z_1, z_2, x$  &  $y_1$ ,  $B$  decreases as  $y_2$  increase.
- v) For fixed values of  $z_2, x, y_1$  &  $y_2$ ,  $B$  decreases as  $z_1$  increase.

The smallest value of occurs when  $x$ -takes its lower bound. i.e),  $x = 1 + \alpha$  and  $y_1, y_2, z_1$  and  $z_2$  take their upper bounds given by  $y_1 = 10 - \alpha, y_2 = 15 - \alpha, z_1 = 20 - \alpha$  and  $z_2 = 25 - \alpha$  respectively. And maximum value of  $P_0$  occurs when  $x = 5 - \alpha, y_1 = 6 + \alpha, y_2 = 11 + \alpha, z_1 = 16 + \alpha$  and  $z_2 = 21 + \alpha$ . If both  $[P_0]_{\alpha}^L$  &  $[P_0]_{\alpha}^R$  are invertible with respect to ' $\alpha$ ' then, the left shape function  $L(B) = [(P_0)_{\alpha}^L]^{-1}$  and right shape function  $R(B) = [(P_0)_{\alpha}^R]^{-1}$  can be obtained and from which the membership function  $\mu_{\bar{P}_0}(B)$  can be constructed as:

$$\mu_{\bar{P}_0}(B) = \begin{cases} 0, & \text{if } B \leq B_1 \\ 0.4(x-2), & \text{if } B_1 \leq B \leq B_2, \\ 0.4(4-x), & \text{if } B_2 \leq B \leq B_3, \\ 0.4(5-x), & \text{if } B_3 \leq B \leq B_4, \\ 0, & \text{if } B \leq B_5 \end{cases} \quad (5.1)$$

The values of  $B_1, B_2, B_3, B_4$  and  $B_5$  as obtained from (5.1) are:

$$\mu_{\bar{P}_1}(B) = \begin{cases} 0, & \text{if } B \leq 0.0000 \\ 0.4(4-x), & \text{if } 0.0000 \leq B \leq 0.3980, \\ 1, & \text{if } x = 1 \\ 0.4(4-x), & \text{if } 0.3980 \leq B \leq 0.7321, \\ 0.4(5-x), & \text{if } 0.7321 \leq B \leq 0.4381, \\ 0, & \text{if } B \geq 0.0000 \end{cases}$$

In the same way we get the following results.

**The server is in the vacation period**

$$\mu_{\bar{P}_1}(C) = \begin{cases} 0, & \text{if } C \leq C_1 \\ 0.6(x-2), & \text{if } C_1 \leq C \leq C_2, \\ 0.6(4-x), & \text{if } C_2 \leq C \leq C_3, \\ 0.6(5-x), & \text{if } C_3 \leq C \leq C_4, \\ 0, & \text{if } C \geq C_5 \end{cases} \quad (5.2)$$

The values of  $C_1, C_2, C_3, C_4$  and  $C_5$  as obtained from (5.2) are:

$$\mu_{\bar{P}_1}(C) = \begin{cases} 0, & \text{if } C \leq 0.0000 \\ 0.6(2-x), & \text{if } 0.0000 \leq C \leq 0.6001, \\ 0.6(4-x), & \text{if } 0.6001 \leq C \leq 0.9965, \\ 0.6(5-x), & \text{if } 0.9965 \leq C \leq 0.5951, \\ 0, & \text{if } C \geq 0.0000 \end{cases}$$



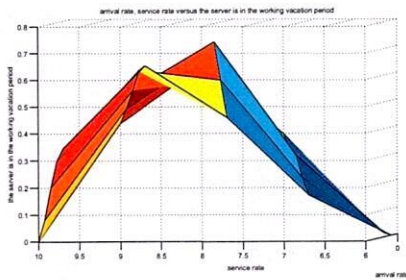
The server is in the regular service period

$$\mu_{\overline{P}_1}(D) = \begin{cases} 0, & \text{if } D \leq D_1 \\ -58(x-2), & \text{if } D_1 \leq D \leq D_2, \\ -58(4-x), & \text{if } D_2 \leq D \leq D_3, \\ 60(5-x), & \text{if } D_3 \leq D \leq D_4, \\ 0, & \text{if } D \geq D_5 \end{cases} \quad (5.3)$$

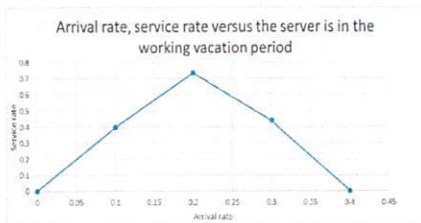
The values of  $D_1, D_2, D_3, D_4$  and  $D_5$  as obtained from (5.3) are:

$$\mu_{\overline{P}_1}(D) = \begin{cases} 0, & \text{if } D \leq 0.0000 \\ -58(2-x), & \text{if } 0.0000 \leq D \leq 59.0721, \\ -58(4-x), & \text{if } 59.0721 \leq D \leq 98.2739, \\ 60(5-x), & \text{if } 98.2739 \leq D \leq 61.0028, \\ 0, & \text{if } D \geq 0.0000 \end{cases}$$

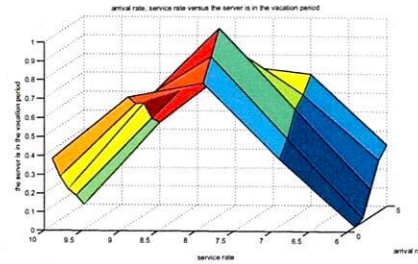
The following three graphs are represent the performanc measures.



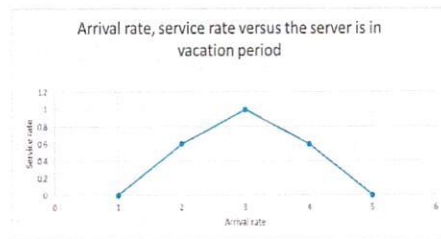
arrival rate, service rate versus the server is in the working vacation period



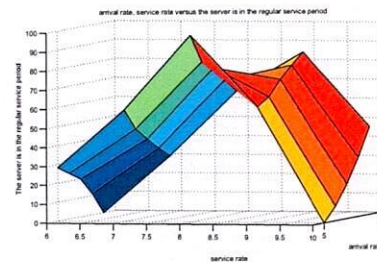
arrival rate, service rate versus the server is in the working vacation period



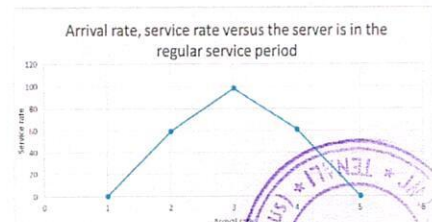
arrival rate, service rate versus the server is in the vacation period



arrival rate, service rate versus the server is in the vacation period



arrival rate, service rate versus the server is in the regular service period



arrival rate, service rate versus the server is in the regular service period

## 6. Conclusion

In this paper we have studied the analysis of the M/M/1





queue with two vacation policies using Pentagonal fuzzy numbers. We have obtained the server is in the working vacation period, server is in the vacation period, the server is in the regular service period. Consider the examples for these fuzzy queues models. The software company working more than 2000 employees, there are taking vacation for traditional holidays like Christmas, Diwali etc and medical leaves. Both policies are a far cry from the days when two weeks vacation and eight fixed holidays were the norm. Each employee is given Rs.15000 a year to spend on airfare, hotels, meals, petrol and other vacation related expenses. We have obtained numerical results to all the performance measures for this fuzzy queues.

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# Energy and Spectrum of an Undirected Graph $\square\square, \square$

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## Energy and Spectrum of an Undirected Graph $G_{m,n}$

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### ABSTRACT

In this paper the notation of  $G_{m,n}$  be a basic simple undirected graph with vertex set  $V = I_n = \{1, 2, 3, \dots, n\}$  and  $u, v \in V$  are adjacent if and only if  $u \neq v$  and  $u + v$  is not divisible by  $m$ , where  $m \in \mathbb{N}$  and  $m > 1$ . We have determined the energies and spectrum of the graph  $G_{m,n}$ .

**AMS Subject Classification:** 05C50, 05C35.

**Keywords:** Energy of a graph, Spectrum of a graph, Matrix energy of a graph.

### 1. INTRODUCTION

The concept of Energy of a Graph was introduced by I. Gutman<sup>1</sup> in 1978. A great variety of graph energies is being considered in the current mathematical chemistry. It can be used to approximate the total  $\pi$ -electron energy of a molecule<sup>2</sup>. This spectrum-based graph invariant has been much studied in both chemical and mathematical literature. Now a day's graph energy is referred to as, closely related to the total  $\pi$ -electron energy calculated within the Huckel molecular orbital approximation<sup>3</sup>.

Let  $G$  be a graph with  $n$  vertices and  $m$  edges and the adjacency matrix of  $A(G)$  of  $G$  is defined by its entries as  $a_{ij} = 1$ , if two vertices are adjacent and 0 otherwise. Let the eigen values of  $A(G)$  be  $\lambda_1, \lambda_2, \lambda_3, \dots, \lambda_n$  where  $\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \dots \geq \lambda_n$ . Then spectral radius  $\lambda_1$  is the highest eigen value of  $G$ . Then we will write  $\lambda_i(G)$  instead of  $\lambda_i$ . We know  $\det A = \prod_{i=1}^n \lambda_i$ . Spectrum is the collection of Eigen values with their multiplicities



$(m_1, m_2, \dots, m_n)$  of an adjacency matrix  $A(G)$ . If at least one of its eigen value is zero, the graph  $G$  is said to be singular and for singular graph  $\det A = 0$ . All eigen values are different from zero then the graph is non-singular, Then  $\det A > 0$ . The energy of  $G$  is defined to be the sum of absolute values of the eigen values of  $G$  and it is denoted by  $\mathcal{E}(G)$ . i.e.,  $\mathcal{E}(G) = \sum_{i=1}^n |\lambda_i|$ , and it is extensively studied by D. Cvetkovia and X.Li.Y.Shi<sup>4,5</sup>.

Nikiforov<sup>6</sup> generalised the matrix energy of any graph is defined as the sum of singular values of the adjacency matrix of  $G$ , and it is denoted by  $\mathcal{E}_m(G)$ .

## 2. THE UNDIRECTED GRAPH ON A FINITE SUBSET OF NATURAL NUMBERS AND ITS PROPERTIES

**Definition 2.1:** Ivy. Chakrabarty<sup>7</sup> introduced an undirected graph  $G_{m,n}$  on a finite subset of natural numbers and proved some basic properties of  $G_{m,n}$ . Let  $G_{m,n}$  be a simple undirected graph with vertex set  $V = I_n = \{1, 2, 3, \dots, n\}$  and  $u, v \in V$  are adjacent if and only if  $u \neq v$  and  $u + v$  is not divisible by  $m$ , where  $m \in N$  and  $m > 1$ . If  $m = 1$ , the graph is disconnected and it forms only isolated vertices. Some of the properties of  $G_{m,n}$  are

**Lemma 2.1:** Let  $m, n \in N$ ,  $m, n > 1$ . Then the graph  $G_{m,n}$  is connected.

**Lemma 2.2:**  $G_{m,n} \cong K_3$  if and only if  $n = 3$  and  $m \geq 6$ .

**Lemma 2.3:**  $G_{m,n}$  is a  $(n - 2)$ -regular graph for  $n = m - 1$ , where  $m$  is odd.

**Lemma 2.4:**  $G_{m,n}$  is a complete  $k$ -partite graph, if  $n = m - 1$ , where  $m$  is odd and  $k = \frac{n}{2}$ .

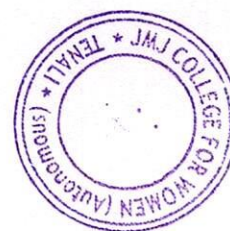
**Lemma 2.5:** Let  $m \geq 2n$ . Then  $G_{m,n}$  is complete.

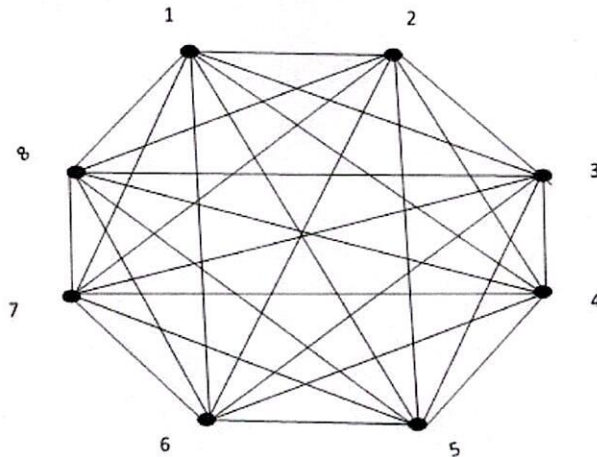
## 3. ENERGY AND SPECTRUM OF A GRAPH $G_{m,n}$ :

**Definition 3.1:** Let  $G_{m,n}$  be an undirected graph with  $n$  vertices and  $m$  be the positive integer  $> 1$  and let  $A = (a_{ij})$  be the adjacency matrix of  $A(G)$  of  $G$  is defined by its entries as  $a_{ij} = 1$ , if two vertices are adjacent and 0 otherwise and  $\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq \dots \geq \lambda_n$  are the eigen values of  $A(G)$ . The spectrum of  $G_{m,n}$  is  $\begin{pmatrix} \lambda_1 & \lambda_2 & \dots & \lambda_n \\ m_1 & m_2 & \dots & m_n \end{pmatrix}$  and the energy is the sum of the absolute values of the eigen values of  $G_{m,n}$ . i.e.,  $\mathcal{E}(G_{m,n}) = \sum_{i=1}^n |\lambda_i|$ .

**Theorem 3.1:** The energy of the graph  $G_{m,n}$  is  $2n - 2$  if  $n \geq 3$  and  $m \geq 2n$ .

**Proof:** Let  $V = \{1, 2, 3, \dots, n\}$  be the vertex set of the graph  $G_{m,n}$  where  $m, n \in N$  and  $m > 1$ . If  $n \geq 3$  and  $m \geq 2n$ , then the graph  $G_{m,n}$  is complete and connected.





For the graph,  $G_{16,8}, \mathcal{E}(G_{16,8}) = 14$

The adjacency matrix of  $G_{m,n}$  graph is an  $n \times n$  matrix defined as  $A(G_{m,n}) = (a_{ij}) =$   
 $\begin{cases} 1, & \text{if } u_i \text{ and } v_j \text{ are adjacent,} \\ 0, & \text{otherwise.} \end{cases}$

$$\text{Then } A(G_{m,n}) = \begin{pmatrix} 0 & 1 & 1 & 1 & \dots & 1 \\ 1 & 0 & 1 & 1 & \dots & 1 \\ 1 & 1 & 0 & 1 & \dots & 1 \\ \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & 1 & 1 & 1 & \dots & 0 \end{pmatrix}_{n \times n}.$$

The characteristic equation is  $|A - \lambda I| = 0$ .

This implies  $(\lambda + 1)^{(n-1)} + [\lambda - (n - 1)] = 0$ .

Therefore  $\text{Spec}(G_{m,n}) = \begin{pmatrix} -1 & n-1 \\ n-1 & 1 \end{pmatrix}$ .

Hence the energy of a graph is  $\mathcal{E}(G_{m,n}) = \sum_{i=1}^n |\lambda_i| = \sum_{j=1}^2 |\lambda_j| \text{spec}(\lambda_j)$   
 $= |\lambda_1| \text{spec}(\lambda_1) + |\lambda_2| \text{spec}(\lambda_2) = 2n - 2$ .

**Theorem 3.2:** The energy of the graph  $G_{m,n}$  is  $2n - 4$  if  $n = m - 1$  where  $m$  is odd and  $\geq 5$ .

**Proof:** Let  $n = m - 1$  where  $m$  is odd and  $\geq 5$ .

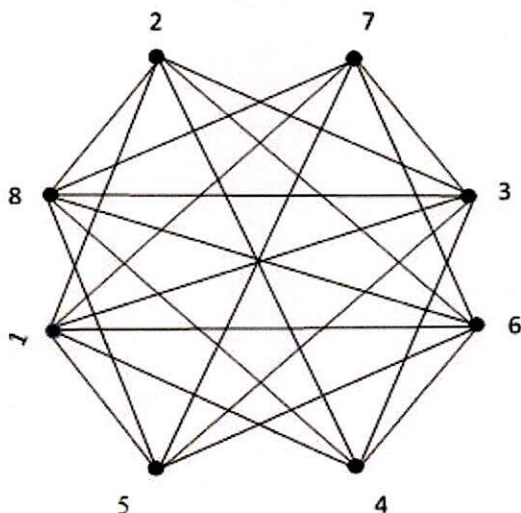
Let  $V = \{m - 1, m - 2, \dots, 2, 1\}$  be the vertex set of  $G_{m,n}$ .

Consider two subsets of  $V$  as  $V_i = \{m - i, i\}$  and  $V_j = \{m - j, j\}$ .

Then the vertex  $m - i$  is adjacent to  $m - j$ ,

Because  $(m - i) + (m - j)$  is not divisible by  $m$  as  $(m - j) \neq i$ .





For the graph,  $G_{9,8}, \mathcal{E}(G_{9,8}) = 12$

The adjacency matrix of the graph  $G_{m,n}$  is  $A(G_{m,n}) =$

$$\begin{pmatrix} 0 & 1 & 1 & 1 & 1 & \dots & 1 & 0 \\ 1 & 0 & 1 & \vdots & \vdots & 1 & 0 & 1 \\ 1 & 1 & \ddots & 1 & 1 & \ddots & 1 & 1 \\ \vdots & \dots & 1 & 0 & 0 & 1 & \dots & \vdots \\ 1 & 1 & \ddots & 1 & 1 & \ddots & 1 & 1 \\ 1 & 0 & 1 & \vdots & \vdots & 1 & 0 & 1 \\ 0 & 1 & 1 & \dots & \dots & 1 & 1 & 0 \end{pmatrix}_{n \times n}$$

and the characteristic equation is  $(\lambda + 2)^{\left(\frac{n}{2}-1\right)} + (\lambda)^{\frac{n}{2}} + (\lambda - (n - 2)) = 0$  and

$$Spec(G_{m,n}) = \left( \begin{array}{ccc} -2 & 0 & n-2 \\ \frac{n}{2}-1 & \frac{n}{2} & 1 \end{array} \right).$$

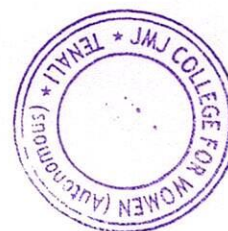
Hence the energy  $\mathcal{E}(G_{m,n}) = 2n - 4$ .

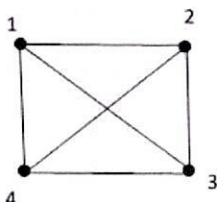
#### 4. MATRIX ENERGY AND SPECTRUM OF A GRAPH $\mathcal{E}_m(G)$ :

**Definition 4.1:** Let  $A(G)$  be the adjacency matrix of  $G$  and  $A(G)'$  be the transpose of  $A(G)$ . Then  $A(G)A(G)'$  is a positive semi definite matrix and the eigen values and singular values of the  $G$  are same. The matrix energy of  $G$  is denoted by  $\mathcal{E}_m(G)$  and is defined as the summation of singular values of  $A(G)$ .so, the energies  $\mathcal{E}(G)$  and  $\mathcal{E}_m(G)$  both are same.

**Theorem 4.1:** The matrix energy of  $G_{m,n}$  is  $2n - 2$  if  $n \geq 3$  and  $m \geq 2n$ .

**Proof:**





For the graph,  $G_{8,4}$ ,  $\varepsilon_m(G_{8,4}) = 6$

$$\text{Then } A(G_{m,n})A'(G_{m,n}) = \begin{pmatrix} n-1 & n-2 & n-2 & \dots & n-2 \\ n-2 & n-1 & n-2 & \dots & n-2 \\ n-2 & n-2 & n-1 & \dots & n-2 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ n-2 & n-2 & n-2 & \dots & n-1 \end{pmatrix}_{n \times n}$$

and the characteristic equation is  $(\lambda - 1)^{n-1} + [\lambda - (n - 1)] = 0$ .

Therefore  $\text{Spec}(G_{m,n}) = \begin{pmatrix} 1 & n-1 \\ n-1 & 1 \end{pmatrix}$  and the singular values are  $1, n - 1$ .

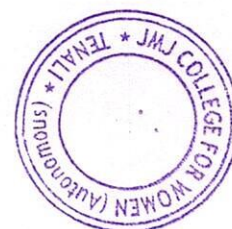
Hence the matrix energy of  $G_{m,n} = \varepsilon_m(G_{m,n}) = \text{summation of singular values of } A(G_{m,n}) = \sum_{j=1}^2 |\lambda_j| \text{spec}(\lambda_j) = |\lambda_1| \text{spec}(\lambda_1) + |\lambda_2| \text{spec}(\lambda_2) = 2n - 2$ .

**Theorem 4.2:** The matrix energy of the graph  $G_{m,n}$  is  $2n - 4$  if  $n = m - 1$  where  $m$  is odd and  $\geq 5$ .

**Proof:** From theorem 3.2, we have

$$A(G_{m,n}) = \begin{pmatrix} 0 & 1 & 1 & 1 & 1 & \dots & 1 & 0 \\ 1 & 0 & 1 & \vdots & \vdots & 1 & 0 & 1 \\ 1 & 1 & \ddots & 1 & 1 & \ddots & 1 & 1 \\ 1 & \dots & 1 & 0 & 0 & 1 & 1 & 1 \\ \vdots & \dots & 1 & 0 & 0 & 1 & \dots & \vdots \\ 1 & 1 & \ddots & 1 & 1 & \ddots & 1 & 1 \\ 1 & 0 & 1 & \vdots & \vdots & 1 & 0 & 1 \\ 0 & 1 & 1 & \dots & \dots & 1 & 1 & 0 \end{pmatrix}_{n \times n}$$

$$\text{Then } A(G_{m,n})A'(G_{m,n}) = \begin{pmatrix} n-2 & n-4 & n-4 & n-4 & n-4 & \dots & n-4 & n-2 \\ n-4 & n-2 & n-4 & \vdots & \vdots & n-4 & n-2 & n-4 \\ n-4 & n-4 & \ddots & n-4 & n-4 & \ddots & n-4 & n-4 \\ n-4 & \dots & n-4 & n-2 & n-2 & n-4 & n-4 & n-4 \\ \vdots & \dots & n-4 & n-2 & n-2 & n-4 & \dots & \vdots \\ n-4 & n-4 & \ddots & n-4 & n-4 & \ddots & n-4 & n-4 \\ n-4 & n-2 & n-4 & \vdots & \vdots & n-4 & n-2 & n-4 \\ n-2 & n-4 & n-4 & \dots & \dots & n-4 & n-4 & n-2 \end{pmatrix}_{n \times n}$$





and the Characteristic equation is  $(\lambda)^{\binom{n-\frac{n}{2}}{}} + (\lambda - 2)^{\binom{n-\frac{n}{2}+1}{}} + (\lambda - (n - 2)) = 0$ .

And the  $Spec(G_{m,n}) = \begin{pmatrix} 0 & 2 & n-2 \\ n-\frac{n}{2} & n-\frac{n}{2}+1 & 1 \end{pmatrix}$ .

Hence the matrix energy of  $G_{m,n} = \varepsilon_m(G_{m,n}) = 2n - 4$ .

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## Woman's Health Status in Indian

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**Abstract:** - Healthy lifestyle and high intake of nutritious food can provide good health throughout life to the humans. The poor nutrition and unawareness on the utilization of health facilities during their childhood and reproductive age are the major factors responsible for the high maternal mortality. Though government of India has been taking a few endeavors to improve the wellbeing status of the ladies, destitution, sex segregation and lack of education in the populace are the serious issues related with the usage of fitting intercessions. The present outline centers the main considerations, which impact the wellbeing worries of the ladies in India.

**Keywords:** Malnutrition; Maternal mortality; Gender discrimination; Women health;  
**India**

### Introduction:

India is one of just a group barely any countries on the planet where women and men have legitimately around a not so distant future during work. The manner in which that the ordinary female piece of room in future isn't found in India prescribes there are conscious issues with women's flourishing. Indian women have high passing rates, particularly during pre-adulthood and in their conceptive years. The idea of Indian women is customarily associated with their status in the open eye. Research on women's status has found that the commitments Indian women make to families as routinely as possible are dismissed, and rather they are viewed as money related weights. There is a strong

youth penchant in India, as youngsters are required to consider protects they age. This kid penchant, near to high gift costs for adolescents, now and again comprehends the maltreatment of youths. Further, Indian women have low degrees of both course and formal work power support. They normally have unimportant self-rule, living emphatically influenced by first their fathers, by then their life associates, in the long run their adolescents (Chatterjee, 1990; Desai, 1994; Horowitz and Kishwar, 1985; The World Bank, 1996). These fragments apply a negative impact on the thriving status of Indian women. Amazing shortcoming has repercussions for women comparatively as their families. Women in bewildering lack will point of fact pass on low weight babies. They furthermore are continuously hesitant to have the choice to give sustenance and sufficient plan to their youngsters. Finally, a woman's prospering impacts the nuclear family financial thriving, as a woman in alarming insufficiency will be less beneficial in the work power.

While women in India face diverse genuine prospering concerns, this profile pivots around only five key issues: regenerative achievement, mercilessness against women, dietary status, conflicting treatment of teenagers and young people, and HIV/AIDS. Because of the wide assortment in social solicitations, religions, and levels of progress among India's 25 states and 7 collusion regions, it isn't shocking that women's flourishing in like manner moves gigantically from state to state. To give a tenaciously pitiable picture, data for the basic states will be showed up at whatever point possible.



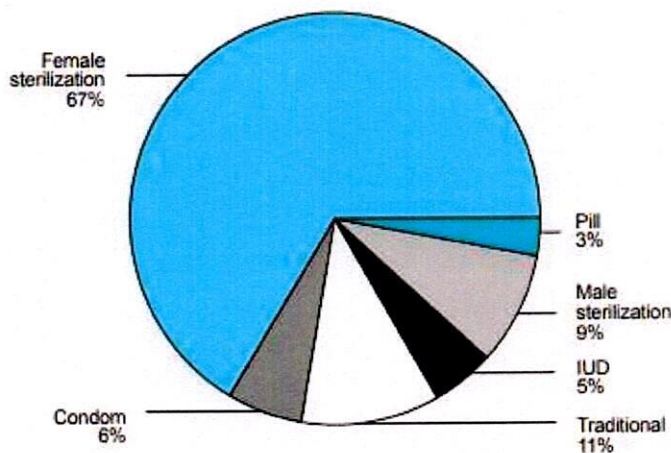


Figure 1. Percentage Distributions into Contraceptive User among the Methods: 2018-2019

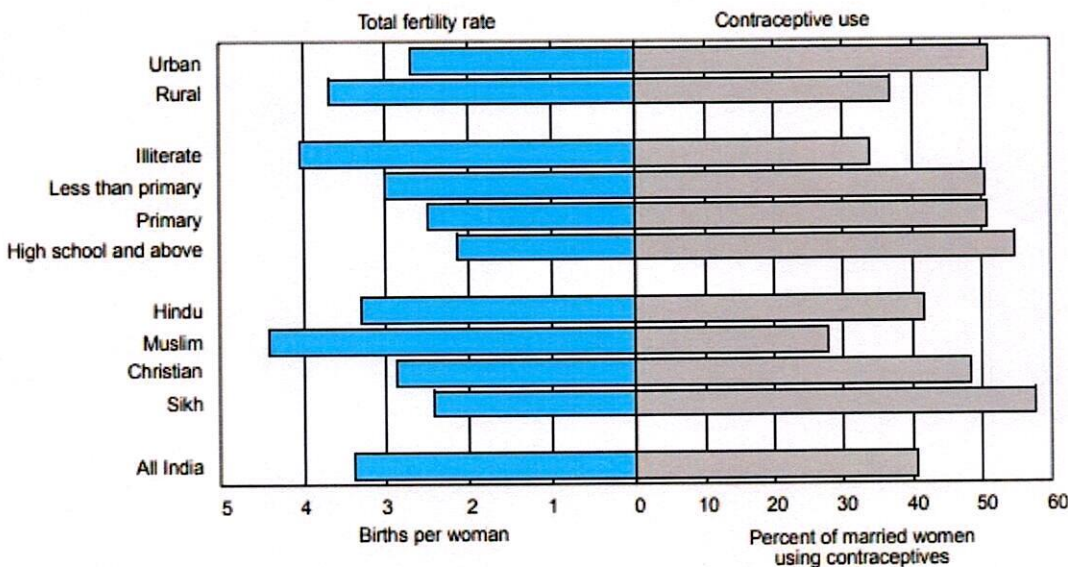
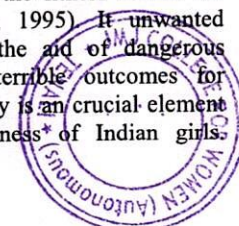


Figure 2. Fertility & Contraceptive Prevalence's: 2017-2019

**Fertility Intertwined With Women Health**

The number of the health problems of Indian ladies are associated with or exacerbated through using immoderate tiers of fertility. Conventional, fertility has been declining in India; with the useful resource of 1992-ninety three the whole fertility fee come to be 3.4 (International Institute for population technological (IIPS), 1995).<sup>1</sup> understanding knowledge, there are big differences in fertility stages thru nation, schooling, faith, caste and place of residence. Utter Pradesh, the maximum populous in India, has a whole fertility rate of over five kids consistent with girl. Knowledge, Kerala, which has particularly immoderate tiers of woman schooling and

autonomy, has a complete fertility fee below 2. high degrees of infant mortality combined with the strong son preference encourage girls to undergo immoderate numbers of youngsters in an try to have a son or stay to inform the tale to maturity. Research has proven that numerous pregnancies and carefully spaced births erode a mom's nutritional popularity, that could negatively have an impact at the being pregnant final effects (e.g., premature births, low starting-weight infants) and moreover growth the fitness hazard for mothers (Jejeebhoy and Rao, 1995). If unwanted pregnancies terminated with the aid of dangerous abortions additionally have terrible outcomes for ladies' health. Lowering fertility is an crucial element in improving the general fitness\* of Indian girls.



Developing the usage of contraceptives is one way to reduce fertility. at the identical time because the of circle of relatives planning is sort of often taking region in India, best 36 percent of married women elderly thirteen to 40 nine presently use modern-day beginning manage (IIPS, 1995).girl sterilization is the number one form of birth control; over -thirds of the married ladies the use of contraception had been sterilized (figure 1).The location of house, training, and faith are strongly associated with every fertility and contraceptive use (determine 2). more than half of married girls with a immoderate college schooling or above use

contraceptives, in assessment to first-class one-0.33 of illiterate ladies. now not mainly, the whole fertility costs for those organizations are considerably unique: 4.0 youngsters for illiterate girls compared to 2.2 kids for ladies with a excessive college schooling or above. Differentials some of the spiritual corporations are also stated; e.g., Muslims have the very excellent widespread fertility fee and the lowest contraceptive use (IIPS, 1995).no matter a huge growth in the variety of ladies using contraceptives and limiting their fertility, there may be though unmet need for contraceptives in India.2 almost 20 percentage

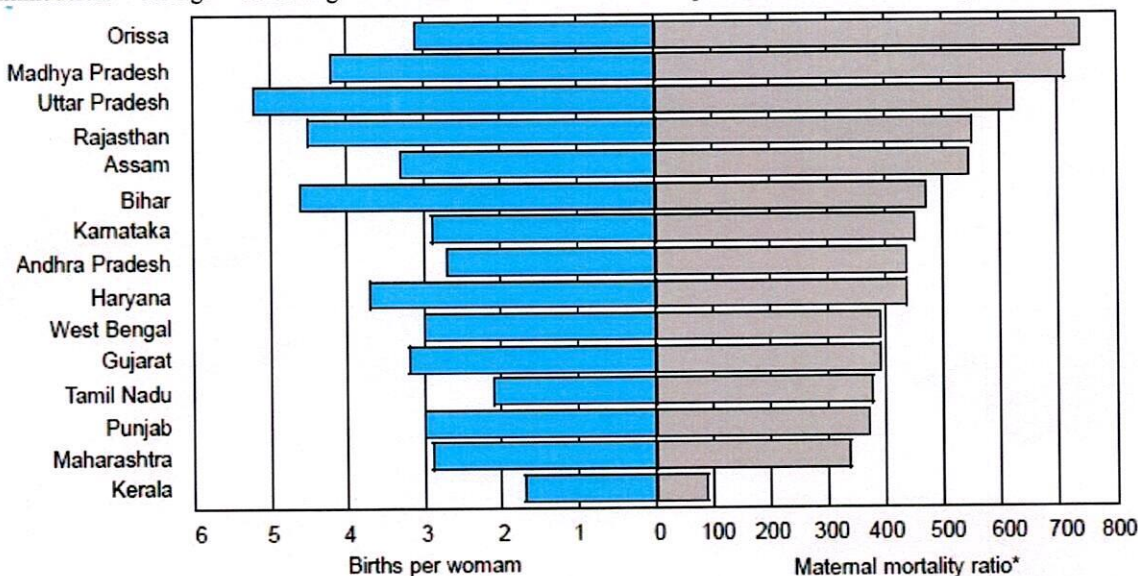


Figure 3. Totally Fertility Rates or Maternal Mortality Ratio through Major States: 1993

To married women in India either want to delay their next birth or have no more children (IIPS, 1995).Most of the unmet need among younger women is for spacing births rather than limiting them.This implies that methods other than female sterilization, the method strongly promoted by India’s family planning program, need to be considered.

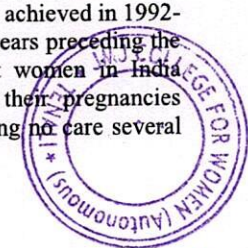
**Over seven-hundred700, 000 Indian girls Die every one year From Pregnancy-associated motives**

Maternal mortality and morbidity are health problems which might be related to excessive ranges of fertility. India has a excessive maternal mortality ratio—about 453 death per 700,000 births in 1993.three This ratio is fifty seven instances the ratio in the United States the area Health Organization (WHO) and United Nations youngsters’ Fund (UNICEF) estimate that India’s maternal mortality ratio is decrease than ratios for Bangladesh and Nepal but higher than the ones for Pakistan and Sri Lanka (WHO, 1996). The level of maternal mortality varies greatly by us of a, with Kerala having the west ratio (87) and states (Madhya Pradesh

and Orissa)having ratios over (decide three)(UNICEF, 1995). This differential maternal mortality is most likely related to versions inside the socioeconomic fame of ladies and get admission to health care services among the states. The immoderate stages of maternal mortality are especially distressing due to the truth most of the people of these deaths can be averted if women had suitable enough health services (each proper prenatal care or referral to appropriate fitness care centers) (Jejeebhoyand Rao, 1995). In truth, the leading contributor to high maternal mortality ratios in India is lack of access to fitness care (the sector economic agency, 1996).

**Few Pregnant Women Receive Prenatal Care**

The maximum cutting-edge country wide Family Health Survey (NFHS) have become achieved in 1992-ninety 3; it located that in the four years preceding the survey, 37 percent of all pregnant women in India obtained no prenatal care during their pregnancies (IIPS, 1995). the proportion receiving no care several



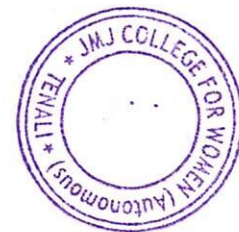
appreciably via the use of educational level and vicinity of residence nearly 1/2 of illiterate women received no care in assessment to just 13 percentage of literate girls. The girls in rural regions were much less possibly to get hold of prenatal care than girls in town areas (42 percent and 18 percentage, respectively). Most girls who did not receive health care at some point of pregnancy said they did no longer because of the fact they believe it was useless (IIPS, 1995). Because of this, there may be a precise want to educate women approximately the importance of health contend with making sure not attended through skilled medical personnel are much more likely to have terrible outcomes for each the mom and the child. The NFHS survey located that nearly three quarters of all births took place at home and -thirds of all births have been not attended through skilled medical personnel. At the same time as fitness care is essential, there are various different factors that have an impact on maternal mortality and fitness. The scientific studies suggest that early age before the whole thing begin and immoderate numbers of stylish pregnancies take their toll on a girl's fitness. Even though fertility has been declining in India, as said earlier, many areas of the use although have excessive tiers. In 1993, five states had ordinary fertility fees of over 4 youngsters regular with female (India Registrar elegant (IRG), 1996a). In popular, excessive maternal mortality ratios are related to immoderate fertility fees (determine 3).

**One in five Maternal Deaths associated with without difficulty treated trouble**

Anemia, which can be dealt with quite in reality and inexpensively with iron drugs, is a few one-of-a-kind thing related to maternal fitness and mortality research have determined that among 50 and ninety percent of all pregnant girls in India be afflicted by anemia excessive anemia money owed for 20 percent of all maternal deaths in India (the arena bank, 1996). Immoderate anemia moreover will increase the danger of demise from a hemorrhage at some point of labor. In each five minutes, a Violent Crime inside the course of

wholesome pregnancies and at ease childbirths. Each exquisite motive for the low degrees of prenatal care is lack of properly enough health care centers. It's miles presently anticipated that 16 percentage of the populace in rural regions lives more than 10 kilometers a long way from any scientific facility (Bhalla, 1995).

Majority of Births in India Take area at domestic area of shipping and form of assist in a few unspecified time inside the destiny of shipping have an effect on maternal health and mortality. Births that take area in non hygienic conditions or births that are a woman Is stated studies thru Heise (1994) has proven that violence in competition to girls is a health hassle that is regularly disregarded thru way of authorities who view such behavior as past their purview. Likewise, many donor corporations do no longer want to work in this problem as they don't forget it culturally touchy. In high quality societies, violence, which consists of partner beating, is perceived as "ordinary" or as a husband's right. However, as Heise concludes, violence in opposition to girls is unfavorable to financial development because it deprives girls of the capability to participate without a doubt inside the financial device with the beneficial resource of depleting each their emotional and bodily strength. Violence within the path of girls can also have awful results for the kids of the victims. On the identical time as violence is a important health hassle for Indian women, it is tough to say how first-rate it's far because of the fact records are confined. The statistics which may be available display an growth within the stated diploma of violent crime inside the direction of women. However, such data do no longer reflect the real ranges of those crimes because of the reality many incidents, specially domestic violence, skip unreported (Kelkar, 1992). The records which can be to be had show that a super deal of the violence to which girls are subjected takes place within the home and/or is accomplished with the beneficial aid of family. As an example, the majority of said rapes are devoted



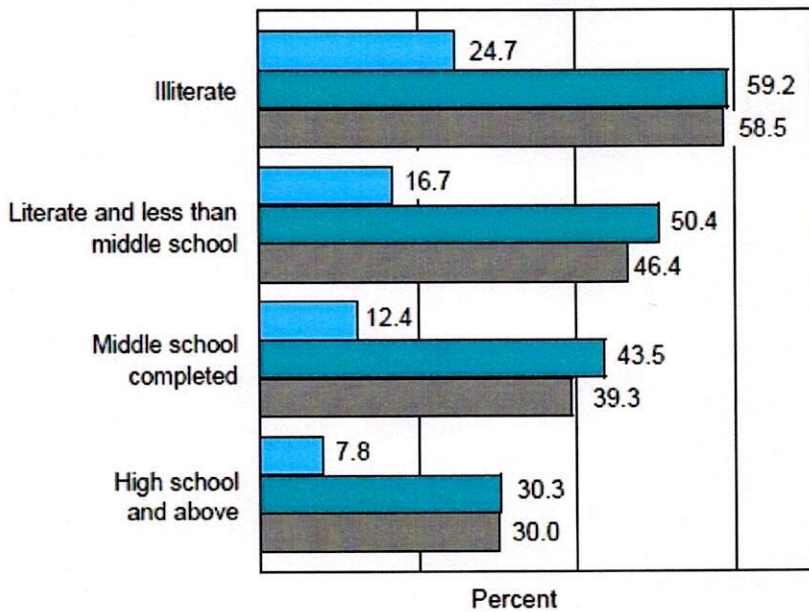


Figure 4. Nutritional Status of the Children under Age 4 by Level of Mother's Educations: 2017-2019

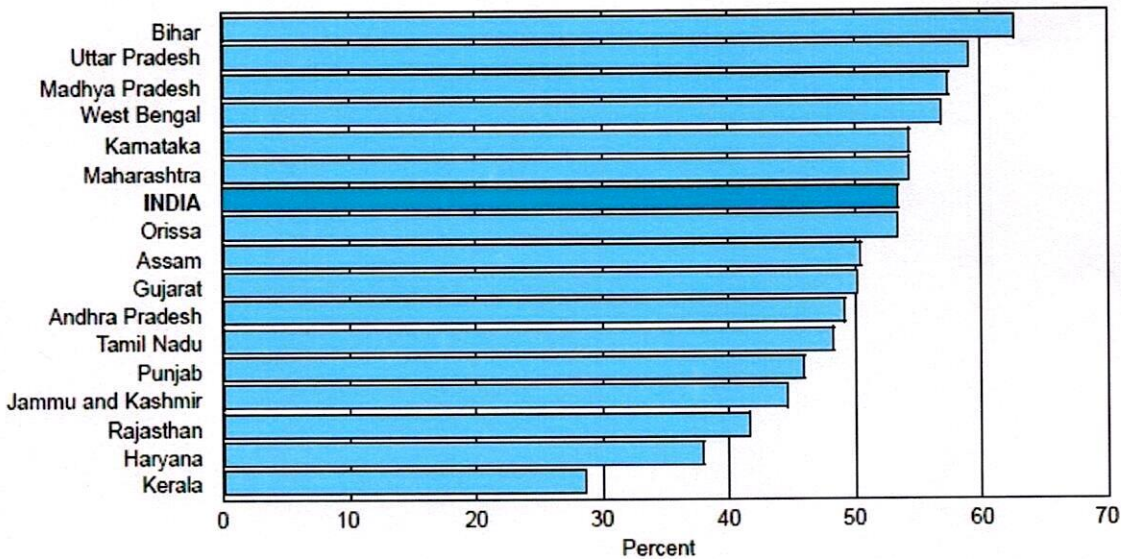


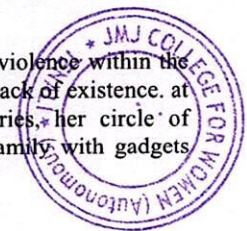
Figure 5. Percent of Undernourished Children, by Major State: 2018-2019

Through family people a number of the patients are more youthful women; 30 percentage of all said rapes came about to ladies who had been age 16 or greater youthful (national Crime data Bureau (NCRB), 1995) within the past few years, there was an increase within the stated incidence of torture — cruelty via way of the husband and the husband's family. The counseled form of incidents of torture elevated ninety 3 percent among 1990 and 1994. The crime rate

for torture has turn out to be five.9 instances in keeping with 700,000 girls in 1994. It frequently women are tortured with the resource of precise girls along with a mother-in-law.

**Dowry Deaths increasing**

The most media-sensation type of violence within the direction of girls in India is dowry lack of existence. at the same time as a woman marries, her circle of relatives provides the husband's family with gadgets



(e.g.,garments, household items, cash). Often, the demand for these offers does now not end with the marriage but keeps, as the husband’s own family persists in making more dowry wishes for years after the marriage. A dowry lack of life is described because the unnatural loss of life of a woman as a result of burns or physical damage occurring inside the first 7 years of marriage, if it can be shown that the girl modified into subjected to cruelty thru using her husband other husband’s accomplice and children shortly before death in connection with a demand for dowry (Johnson, 1996; Prasad, 1996). nearly 5,000women had been noted to have suffered this form of lack of life in 1994, approximately 1 dowry loss of existence for every100,000 girls (NCRB, 1995).The actual variety is definitely larger, as there are many deaths that need to be stated as a dowry death and are not while research have confirmed that dowry-related violence against women occurs among all subgroups of the populace, the rates are better many of the horrible and the lower castes. Alcoholism is also associated with will increase in-violence in competition to girls (Rao and Bloch, 1993).

**Nowhere to show**

The regrettably, due to the reality many crimes in opposition to girls are domestic, girls have restricted recourse. Many ladies who suffer from domestic violence have little or no education, are not possibly to be able to assist themselves, and are unlikely in case you need to turn to their parents within the event that they leave their husbands due to the reality their dad and mom either will now not(because of the social stigma) or cannot (because of economics) take them in. normally, the police have now not been helpful to women in domestic violence cases, and there are few community resource programs available to the ones women(Johnson et al., 1996; Kelkar,1992). Therefore, many sufferers of domestic violence stay in abusive situations extra

**Than half of of of Indian Children Are Malnourished**

The several research suggest that malnutrition is a few other serious health problem that Indian ladies face (Chatterjee, 1990);

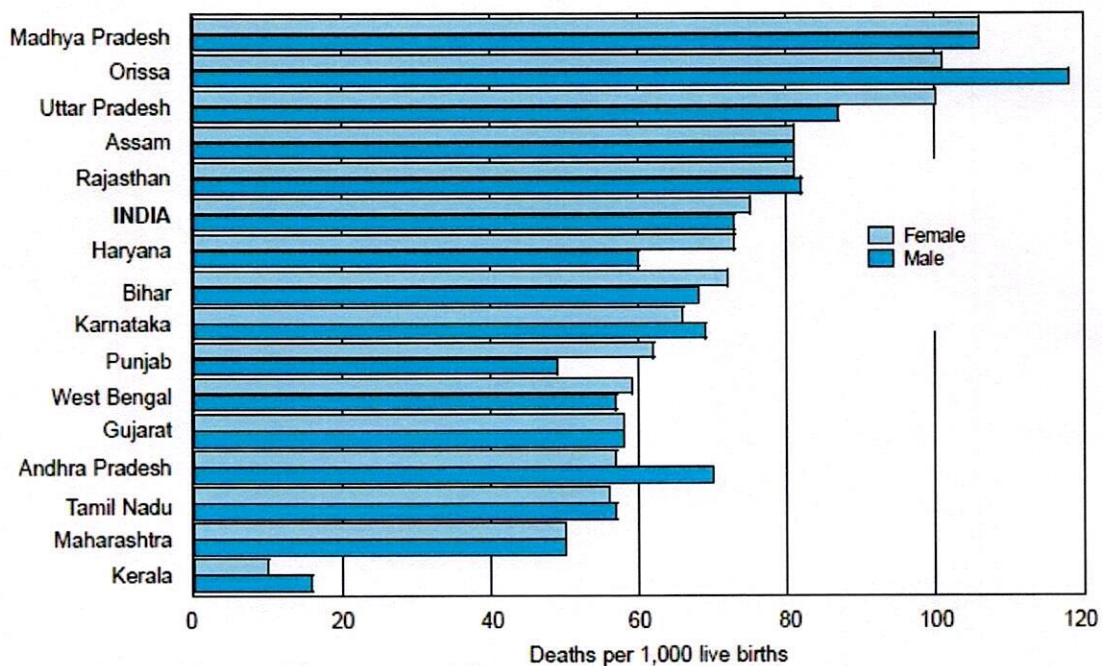
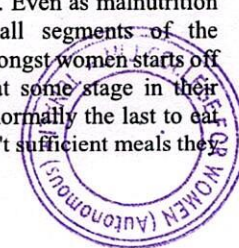


Figure 6. Infant Mortality Rate, by Sex, for Major States: 2018

1994; the sector financial institution, 1996). It threatens their survival in addition to that during their youngsters. The terrible results of malnutrition amongst women are compounded via the usage of the use of way of heavy paintings desires, by way of the use of manner of poverty, with the useful resource of childbearing and rearing, and through special nutritional goals of ladies,

ensuing in prolonged susceptibility to contamination and consequent higher mortality. Even as malnutrition in India is ordinary among all segments of the population, horrible vitamins amongst women starts off evolved in infancy and keeps at some stage in their lifetimes. women and girls are normally the last to eat in a family; therefore, if there isn't sufficient meals they



may be those to go through maximum (Horowitz and Kishwar, 1985). Consistent with the NFHS, Indian kids have some of the most proportions of malnourishment in the worldwide. The greater than half of of (fifty 3 percentage) of all girls and boys under4 years of age had been malnourished, and a similar percentage (52 percent) have been stunted (i.e., too brief for their age). unique studies display that many ladies by no means gain whole bodily improvement (the sector economic organization, 1996). This incomplete physical improvement poses a significant hazard for women via developing the danger of obstructed deliveries.

**Mother’s schooling strongly associated with youngster’s Malnutrition**

Mom’s schooling, in step with the NFHS, is rather correlated with the quantity of malnutrition amongst children (determine four). kids of illiterate mothers are two instances as likely to be undernourished or stunted as youngsters whose mothers have finished as a minimum excessive university. The differentials are even massive whilst significantly undernourished kids

are taken into consideration. Youngsters of illiterate mothers are three times as probable to be substantially undernourished as children of moms with at the least a immoderate college schooling. nutritional popularity of children additionally differs via of America (discern five). Bihar and Uttar Pradesh have the very best percentage of undernourished children and Kerala has the bottom, everyday with the superb tiers of socio-monetary development in the ones states.

**More lady Deaths**

The several research have positioned that one of the motives for the terrible health of Indian women is the discriminatory remedy ladies and girls collect in evaluation to boys and guys. The most chilling evidence of that is the large amount of “lacking women” (i.e., ladies and ladies who have apparently died as a result of past and present discrimination). estimates place this variety at about 35 million (the location economic organization, 1996). In specific terms, there's a deficit of 35 million

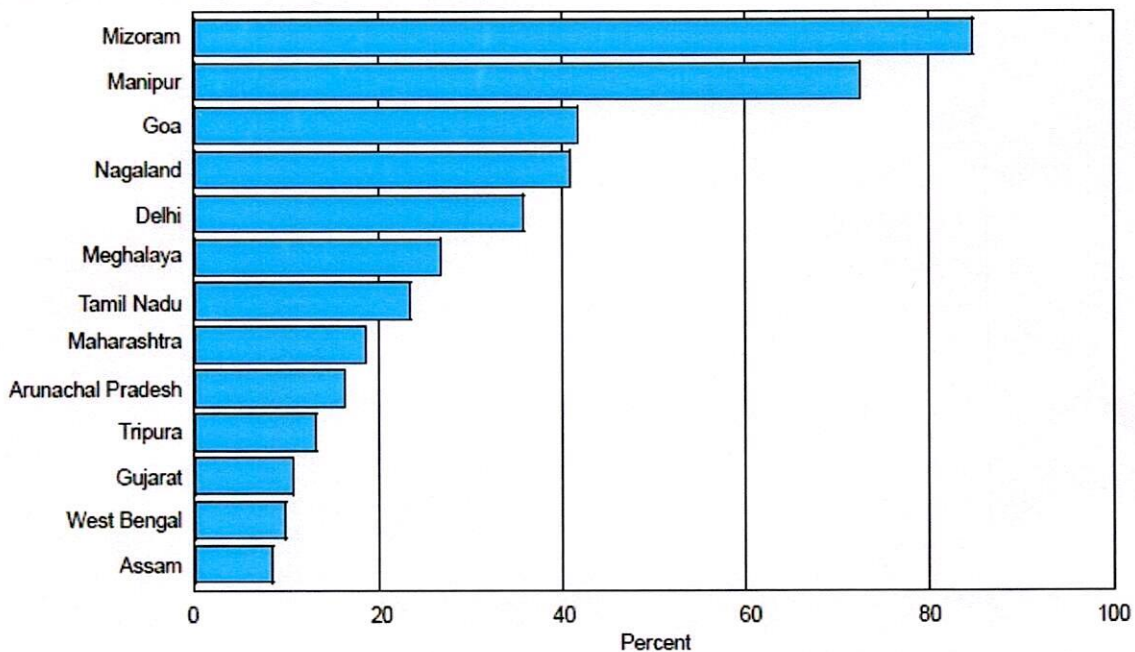
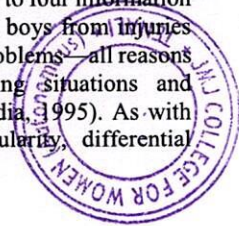


Figure 7. Percent of Ever-Married Women Who Have Heard About AIDS in Selected States: 2017-19

Women or women who need to be part of the populace understanding but aren't. This deficit of ladies is because of higher lady than male mortality prices for every age organization as a splendid deal as age 30 (IRG, 1996a).4 Differential remedy of women and boys in phrases of feeding practices and get admission to to fitness care is some of the elements accountable for better female mortality. The resulting from their decrease popularity conventional, ladies enjoy discrimination inside the allocation of family belongings at the side of food and get proper of access

to fitness offerings. Boys are breast-fed longer than ladies; 25.3 months in choice to 23.6 months on common (IIPS, 2018). Boys who're ill are much more likely to be taken for scientific remedy than are girls (Bhalla, 2018; Jejeebhoy and Rao, 2019). It causes of loss of existence for children aged 1 to four information women death at a higher rate than boys from injuries and injuries, fever, and digestive problems—all reasons which can be related to residing situations and negligence. The government of India (1995). As with special symptoms of health popularity, differential





treatment of boys and women varies through way of using country. The toddler mortality rate via way of sex can be used as a proxy for differential remedy. Inside the huge majority of countries worldwide, men have better mortality in infancy than do girls better girl expenses are consequently considered possibly to signal discrimination towards ladies. Handiest 7 of the 15 primary states in India have higher male little one mortality (parent 6) inside the ultimate states, equal or better girl expenses recommend that girls undergo more overlook about.

One of the maximum intense manifestations of son desire is sex selective abortion. the use of clinical generation to determine the intercourse of a fetus is at the rise in India, and over 90 percentage of fetuses which can be aborted are lady (the arena monetary company, 1996). In all worldwide places, greater boys are born than girls, with a intercourse ratio at beginning round one hundred and five boys in keeping with 100 girls. facts on clinic births from various additives of India knowledge that sex-selective abortion has stepped forward the sex ratio at shipping to 112 boys in keeping with 100 women (Das Gupta, 1994).

**HIV/AIDS in India is a touch- Understood Epidemic**  
The HIV/AIDS epidemic in India is spreading hastily and increasingly will have an effect on girls' fitness in coming years. An extremely-current take a look at anticipated that among 2 and 5 million Indians are presently infected with HIV (AIDS manipulate and Prevention mission of circle of relatives fitness worldwide et al., 1996). The very nice fees of contamination are decided in population groups with effective high risk behaviors (i.e., sex personnel, intravenous drug users, and sexually transmitted disease patients). The information, contamination is likewise developing inner the fashionable population. As an instance, HIV seroprevalence among pregnant women inside the united states of america of Tamil Nadu quadrupled among 2017 and 2019 from 0.2 to 0.8 percent (U.S. Bureau of the Census, 1995). The epidemic is fueled through each married and unmarried guys visiting sex employees who've immoderate charges of contamination. Migrant employee's and truck drivers are important components of the spread of HIV. Surveys in a few regions knowledge five to 10percent of truck drivers in the country are HIV infected (AIDS Analysis, 1996).however the alarming boom of the epidemic, maximum ladies in India have very little of AIDS. The NFHS determined that a large majority of Indian girls had never heard of AIDS. Even amongst those who had heard of the ailment, there had been many misconceptions about modes of transmission.

Indian ladies ought to advantage from a bolstered countrywide HIV/AIDS education software and

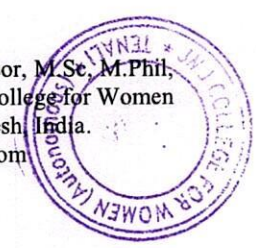
intervention applications targeting groups most susceptible to HIV contamination.

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# Using Divisor Function and Euler Product Function in Abstract Algebra Concepts

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**Abstract:** Algebraic number theory is a branch of number theory that uses the techniques of abstract algebra to study the integers, rational numbers, and their generalizations. Number-theoretic questions are expressed in terms of properties of algebraic objects such as algebraic number fields and their rings of integers, finite fields, and function fields. These properties, such as whether a ring admits unique factorization, the behavior of ideals, and the Galois groups of fields, can resolve questions of primary importance in number theory. In this paper for the most part centered around number theory ideas which are utilized in different themes like group theory and ring theory, these speculations are extremely unique ideas to comprehend among this we might want to express our perspectives as far as number hypothesis/theory ideas, such as, to calculate some subgroups of a cyclic group, number of ideals, principal ideals of a ring and number of generators of a cyclic group as far as both regular procedure and number speculation/hypothesis thoughts.

**Keywords:** Divisors Function, Euler's Phi-function, Field, Number Theory, Abstract Algebra

## 1. Introduction

The theory of numbers is an area of mathematics which deals with the properties of whole and rational numbers. Analytic number theory is one of its branches, which involves study of arithmetical functions, their properties and the interrelationships that exist among these functions. In this paper I will introduce some of the three very important examples of arithmetical functions, as well as a concept of the possible operations we can use with them. There are four propositions which are mentioned in this paper and I have used the definitions of these arithmetical functions and some Lemmas which reflect their properties, in order to prove them.

Algebraic number theory is a branch of number theory that uses the techniques of abstract algebra to study the integers, rational numbers, and their generalizations. Number-theoretic questions are expressed in terms of

properties of algebraic objects such as algebraic number fields and their rings of integers, finite fields, and function fields. These properties, such as whether a ring admits unique factorization, the behavior of ideals, and the Galois groups of fields, can resolve questions of primary importance in number theory, like the existence of solutions to Diophantine equations.

List of Symbols:

$\sum$  : Summation

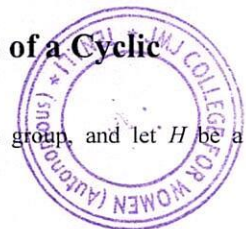
$\prod$  : Product

$\tau(n)$  : Number of divisors function

$\phi(n)$  : Euler's phi-function

## 2. Number of Subgroups of a Cyclic Group

Definition. Let  $G$  be an abelian group, and let  $H$  be a



non-empty subset of  $G$  such that

$$a+b \in H \text{ for all } a, b \in H \text{ and } -a \in H \text{ for all } a \in H$$

Then  $H$  is called a subgroup of  $G$ .

In words:  $H$  is a subgroup of  $G$  if it is closed under the group operation and taking inverses.

Multiplicative notation: if the abelian group  $G$  in the above definition is written using multiplicative notation, then  $H$  is a subgroup if  $ab \in H$  and  $a^{-1} \in H$  for all  $a, b \in H$ .

Definition:

A group  $G$  is called cyclic if there exists an element  $g$  in  $G$  such that  $G = \langle g \rangle = \{g^n \mid n \text{ is an integer}\}$ . Since any group generated by an element in a group is a subgroup of that group, showing that the only subgroup of a group  $G$  that contains  $g$  is  $G$  itself suffices to show that  $G$  is cyclic.

Example 1:

If  $G$  is a cyclic group of order 12 then the number of subgroups of  $G$ .

Solution:

Here the number 12 is finite and small number so to find out subgroup of these are very small task because the number of divisors of 12 are 1, 2, 3, 4, 6, and 12 so number of subgroups is 6.

If the number is large then to find out the number of subgroups is very difficult and time consuming process so to reduce this difficulty by using the following number theory concepts.

Definition: (Prime and Composite). An integer  $n > 1$  is prime if it the only positive divisors of  $n$  are 1 and  $n$ . We call  $n$  composite if  $n$  is not prime.

The number 1 is neither prime nor composite.

The first few primes of  $N$  are

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79.. .. .

The first few composites are

4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28, 30, 32, 33, 34.. .. .

Definition: (Divisor function)

The divisor function  $\sigma_k(n)$ : for  $n$  an integer is defined as the sum of the  $k^{\text{th}}$  powers of the (positive integer) divisors of  $n$ ,

$$\sigma_k(n) = \sum_{d|n} d^k$$

It is implemented in the Wolfram Language as Divisor Sigma  $[k, n]$ .

The notations  $d(n)$  (Hardy and Wright 1979, p. 239),  $\nu(n)$  (Ore 1988, p. 86), and  $\tau(n)$  (Burton 1989, p. 128) are sometimes used for  $\sigma_0(n)$ , which gives the number of divisors of  $n$ . Rather surprisingly, the number of factors of the polynomial  $a^n - b^n$  are also given by  $d(n)$ . The values of  $\sigma_0(n)$  can be found as the inverse Möbius transform of 1, 1, 1,..... (Sloane and Plouffe 1995, p. 22). Heath-Brown (1984) proved that  $\sigma_0(n) = \sigma_0(n+1)$  infinitely often. The numbers having the incrementally largest number of divisors are called

highly composite numbers. The function  $\sigma_0(n)$  satisfies the identities

$$\sigma_0(p^a) = a + 1$$

$$\sigma_0(p^{a_1} p^{a_2} \dots) = (a_1 + 1)(a_2 + 1) \dots$$

Where the  $p_i$  are distinct primes and  $p^{a_1} p^{a_2} \dots$  is the prime factorization of a number  $n$ .

The divisor function  $\sigma_0(n)$  is odd iff  $n$  is a square number.

The function  $\sigma_1(n)$  that gives the sum of the divisors of  $n$  is commonly written without the subscript, i.e.,  $\sigma(n)$ .

As an illustrative example of computing  $\sigma_k(n)$ , consider the number 140, which has divisors  $d_i = 1, 2, 4, 5, 7, 10, 14, 20, 28, 35, 70$ , and 140, for a total of  $N=12$  divisors in all. Therefore,

$$\sigma_0(140) = N = 12$$

$$\sigma_1(140) = \sum_{i=1}^N d_i = 336$$

$$\sigma_2(140) = \sum_{i=1}^N d_i^2 = 27300$$

$$\sigma_3(140) = \sum_{i=1}^N d_i^3 = 3164112$$

The divisor function can also be generalized to Gaussian integers. The definition requires some care since in principle, there is ambiguity as to which of the four associates is chosen for each divisor. Spira (1961) defines the sum of divisors of a complex number  $Z$  by factoring  $Z$  into a product of powers of distinct Gaussian primes,

Theorem 1: (fundamental theorem of arithmetic)

Every integer  $n \geq 2$  has a factorization as a

Product of prime powers:

$$n = p_1^{e_1} p_2^{e_2} p_3^{e_3} \dots p_k^{e_k}$$

Where the  $p_i$  are distinct primes and the  $e_i$  are positive integers. Furthermore, the factorization is unique up to rearrangement of factors.

To find the number of divisors of any positive integer first to express different types of prime product in a unique way

$$\text{i.e., } n = p_1^{e_1} p_2^{e_2} p_3^{e_3} \dots p_k^{e_k}$$

Number of divisors of  $n$  is denoted by the symbol  $\tau(n)$

$$\tau(n) = (1 + e_1)(1 + e_2) \dots (1 + e_k)$$

$\therefore$  Number of subgroups of a cyclic group is of order  $n$  is  $\tau(n)$



Example 2:

If G is a cyclic group of order 2512 then the no. of subgroups.

Here to find the number of divisors of 2512 manually is difficult but it can be reduced as product of primes is the easy way

$$\begin{aligned} \text{So, } 2512 &= 2 \times 1256 \\ &= 22 \times 628 \end{aligned}$$

$$= 2 \times 2 \times 2 \times 314$$

$$= 2 \times 2 \times 2 \times 2 \times 157$$

$$= 2^4 \times 157^1$$

here 157 is prime number

$$\therefore 2512 = 2^4 \times 157^1$$

$\therefore$  Number of subgroups of a cyclic group is of order 2512 is  $\tau(n) = (4+1)(1+1) = 5 \cdot 2 = 10$ .

Table 1. Number of Subgroups of Some groups.

S. No	Order of Group	Prime factorization	No. of subrings
1	10000000	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$	81
2	123456789	$127 \times 9721$	4
3	987654321	$2 \times 2 \times 2 \times 37 \times 333667$	16
4	432198765	$29 \times 149$	4
5	765432198	$2 \times 3 \times 3 \times 13 \times 1847$	24
6	2029	2029	2

Note:

If n is composite number then no. of subgroups are  $\tau(n)$

If n is Prime number then the no of subgroups are 2 only.

No. of proper subgroups of order n is  $\tau(n) - 2$

No. of improper subgroups are 2 only

### 3. Number of Ideals and Principal Ideals of a Ring R

Definition: A non-empty subset S of a ring  $(R, +, *)$  is called an ideal of R if

$(S, +)$  is an abelian group of  $(R, +)$

for all  $s \in S$  then  $rs$  &  $sr \in S$

Definition: An ideal of a ring R is said to be a principal ideal if it is generated by single element of R

i.e., if  $a \in R$  then a set generated by "a" or  $\langle a \rangle$  is a principal ideal of r

$$\langle a \rangle = \{ax \mid \forall x \in R\} \subseteq R$$

Fact: Number of different ideals and principal ideals for the ring  $(Z_n, +, \cdot)$  is  $\tau(n)$

Example 3: Number of different ideals and principal ideals of the ring  $(Z_{2019}, +, \cdot)$

$$n = 2019$$

$$= 3 \times 673 \text{ here } 673 \text{ is a prime number}$$

$\therefore$  Number of different ideals and principal ideals are  $(1+1)(1+1) = 2 \cdot 2 = 4$ .

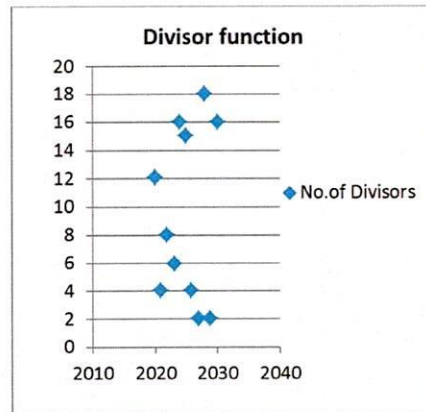


Figure 1. Divisor Function.

Table 2. Number of Ideals and Principal ideals of a Ring.

S. No	Ring	Prime factorization	No. of ideals and principal ideals
1	$(Z_{2020}, +, \cdot)$	$2 \times 2 \times 5 \times 101$	12
2	$(Z_{2021}, +, \cdot)$	$43 \times 47$	4
3	$(Z_{2022}, +, \cdot)$	$2 \times 3 \times 337$	8
4	$(Z_{2023}, +, \cdot)$	$7 \times 17 \times 17$	6
5	$(Z_{2024}, +, \cdot)$	$2 \times 2 \times 11 \times 23$	16
6	$(Z_{2025}, +, \cdot)$	$3 \times 3 \times 3 \times 5 \times 5$	15
7	$(Z_{2026}, +, \cdot)$	$2 \times 1013$	4
8	$(Z_{2027}, +, \cdot)$	2027	2
9	$(Z_{2028}, +, \cdot)$	$2 \times 2 \times 3 \times 13 \times 13$	18
10	$(Z_{2029}, +, \cdot)$	2029	2

Graphical Representation of Euler totient function use of between 2020-2030.



### 4. Number Generators of a Cyclic Group

Proposition: Let G be a cyclic group of order n, then G has  $\phi(n)$  generators.

Theorem: (A product formula for  $\phi(n)$ )

Statement: for  $n \geq 1$  we have  $\phi(n) = n \prod_{p|n} (1 - \frac{1}{p})$ .

Proof: for  $n=1$  the product is empty since there are no

primes which divide 1

In this case it is understood that the product is to be assigned the value 1

$$\therefore \phi(1) = 1.$$

Suppose that  $n > 1$  and let  $p_1, p_2, p_3, \dots, p_r$  be distinct prime divisors of n. Now the product can be taken as

$$\prod_{p|n} (1 - \frac{1}{p}) = \prod_{i=1}^r (1 - \frac{1}{p_i}), \prod_{p|n} (1 - \frac{1}{p}) = (1 - \frac{1}{p_1})(1 - \frac{1}{p_2}) \dots (1 - \frac{1}{p_r})$$

$$\prod_{p|n} (1 - \frac{1}{p}) = 1 - \sum \frac{1}{p_i} + \sum \frac{1}{p_i p_j} - \sum \frac{1}{p_i p_j p_k} + \dots + \sum \frac{1}{p_i p_j p_k \dots p_r}$$
(1)

On the right hand side, in a term such as  $\sum \frac{1}{p_i p_j p_k}$  it is understood that we consider all possible products  $p_i p_j p_k$  of distinct prime factors of n taken three at a time. Also each term on the right hand side of equation (1) is of the form  $\pm \frac{1}{d}$  where d is a divisor of n which is either 1 or a product of distinct primes. The numerator  $\pm 1$  is exactly  $\mu(d)$ .

Since  $\mu(d) = 0$  if d is divisible by the square of any  $p_i$ , the sum in equation (1) is exactly the same as  $\sum_{d|n} \frac{\mu(d)}{d}$ .

$\therefore$  Equation (1) can be written as

$$\prod_{p|n} (1 - \frac{1}{p}) = \sum_{d|n} \frac{\mu(d)}{d}$$

now multiplying the above relation with n on both sides, we get

$$n \prod_{p|n} (1 - \frac{1}{p}) = n \sum_{d|n} \frac{\mu(d)}{d}, n \prod_{p|n} (1 - \frac{1}{p}) = n \sum_{d|n} \mu(d) \frac{n}{d}$$

But we know that

$$\phi(n) = \sum_{d|n} \mu(d) \cdot \frac{n}{d}$$

$$\phi(n) = n \prod_{p|n} (1 - \frac{1}{p})$$

$$\therefore \phi(n) = n \prod_{p|n} (1 - \frac{1}{p})$$

Complete the proof.

Example 4: If G is a cyclic group of order 2512 then the numbers of generators of G are

$$2512 = 2 \times 2 \times 2 \times 2 \times 157$$

$$\phi(2512) = 2512(1 - \frac{1}{2})(1 - \frac{1}{157}) = 2512(\frac{1}{2})(\frac{156}{157})$$

$$= 1256(\frac{156}{157})$$

$$= 8 \times 156$$

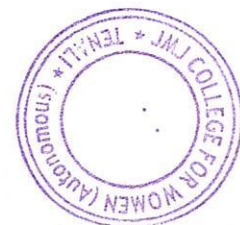
$$= 1248$$

Number of generators of cyclic group of order 2512 is 1248.

Table 3. No of generators of a cyclic group between 1 to 143.

$\phi(n)$ for $1 \leq n \leq 143$												
+	0	1	2	3	4	5	6	7	8	9	10	11
0	N/A	1	1	2	2	4	2	6	4	6	4	10
12	4	12	6	8	8	16	6	18	8	12	10	22
24	8	20	12	18	12	28	8	30	16	20	16	24
36	12	36	18	24	16	40	12	42	20	24	22	46
48	16	42	20	32	24	52	18	40	24	36	28	58
60	16	60	30	36	32	48	20	66	32	44	24	70
72	24	72	36	40	36	60	24	78	32	54	40	82
84	24	64	42	56	40	88	24	72	44	60	46	72
96	32	96	42	60	40	100	32	102	48	48	52	106
108	36	108	40	72	48	112	36	88	56	72	58	96
120	32	110	60	80	60	100	36	126	64	84	48	130
132	40	108	66	72	64	136	44	138	48	92	70	120

Graphical Representation of  $\phi(n)$  for  $1 \leq n \leq 143$ .



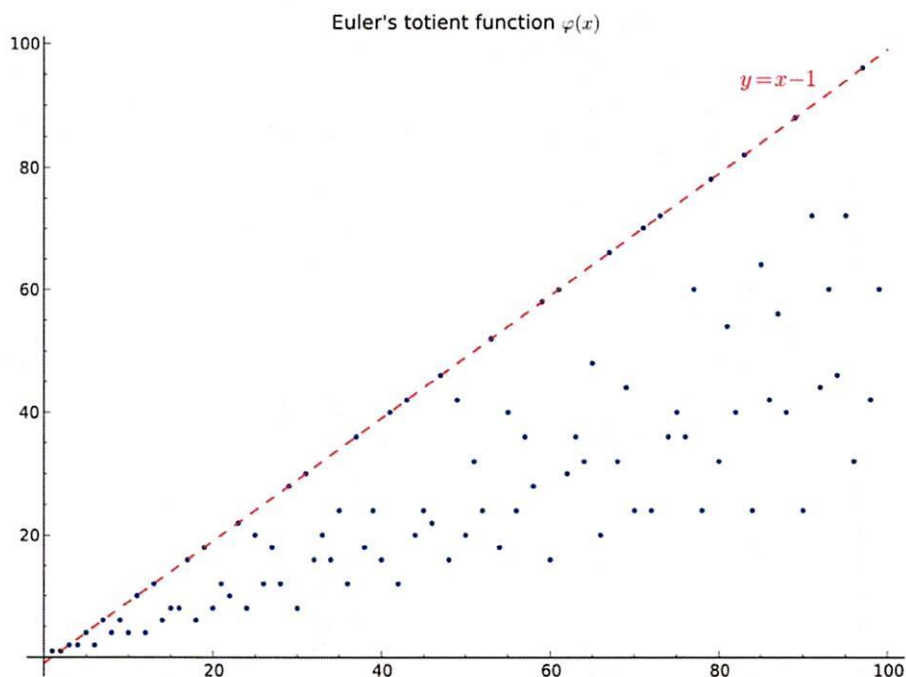


Figure 2. Euler's totient function.

#### Properties of Euler's Totient Function:

1. For a prime number  $p$ ,  $\phi(p)$  is  $p-1$ . For example  $\phi(5)$  is 4,  $\phi(7)$  is 6 and  $\phi(13)$  is 12. This is obvious; gcd of all numbers from 1 to  $p-1$  will be 1 because  $p$  is a prime.
2. For two numbers  $a$  and  $b$ , if  $\gcd(a, b)$  is 1, then  $\phi(ab) = \phi(a) * \phi(b)$ . For example  $\phi(5)$  is 4 and  $\phi(6)$  is 2, so  $\phi(30)$  must be 8 as 5 and 6 are relatively prime.
3. For any two prime numbers  $p$  and  $q$ ,  $\phi(pq) = (p-1)*(q-1)$ . This property is used in RSA algorithm.
4. If  $p$  is a prime number, then  $\phi(p^k) = p^k - p^{k-1}$ . This can be proved using Euler's product formula.
5. Sum of values of totient functions of all divisors of  $n$  is equal to  $n$ .  $\sum_{d|n} \phi(d) = n$
6. The most famous and important feature is expressed in Euler's theorem  
The theorem states that if  $n$  and  $a$  are coprime (or relatively prime) positive integers, then  $a^{\phi(n)} = 1 \pmod{n}$
7. Number of generators of a finite cyclic group under modulo  $n$  addition is  $\phi(n)$ .

#### Algebraic Significance

- a) Number of subgroups of the cyclic group: For any natural number  $n$ ,  $\sigma_0(n)$  equals the number of subgroups of the cyclic group of order  $n$ , under the action of the automorphism group.
- b) Number of automorphism classes of elements in the cyclic group: For any natural number  $n$ ,  $\sigma_0(n)$  equals the number of equivalence classes of elements in the cyclic group of order  $n$ , under the action of the automorphism group. In fact, two elements are in the same automorphism class if and only if they generate the

same subgroup. The sizes of these equivalence classes are  $\phi(d)$  for the divisors  $d$  of  $n$ , and this is a combinatorial proof of the fact that  $\sum_{d|n} \phi(d) = n$ .

- c) Number of associate classes of elements in the ring of integers modulo  $n$ : For any natural number  $n$ ,  $\sigma_0(n)$  equals the number of equivalence classes of elements in the ring of integers modulo  $n$ , under the relation of being associate elements. In fact, the equivalence classes of associate elements are precisely the same as the equivalence classes under the action of auto morphisms of the additive group of the ring. Thus, their sizes are  $\phi(d)$ , for the divisors  $d$  of  $n$ .
- d) Number of irreducible factors of the polynomial  $x^n - 1$  over  $\mathbb{Q}$ : This polynomial is a product of irreducible factors called cyclotomic polynomials for the divisors  $d$  of  $n$ , where  $\phi_d$  has as its roots the primitive  $d^{\text{th}}$  roots of unity. The degree of  $\phi_d$  is  $\phi(d)$ .

## 5. Conclusions

In number theory, the divisor function is a function that is a sum over the divisor function. It every now and again happens in the investigation of the asymptotic behavior of the Riemann zeta function. The different investigations of the behavior of the divisor function are sometimes called divisor problems.

Euler's totient function is a multiplicative function, meaning that if two numbers  $m$  and  $n$  are relatively prime, then

$$\Phi(mn) = \phi(m)\phi(n)$$

This function gives the order of the multiplicative group of

integers modulo  $n$  (the group of units of the ring  $\mathbb{Z}/n\mathbb{Z}$ ). It additionally assumes a key job in the meaning of the RSA encryption framework.

### Acknowledgements

I would like to express my very great appreciation to our Post graduate students for his valuable and constructive suggestions during the planning and development of this work. I would also like to thank our staff members, Head and Principal of the Besant Theosophical College.

Finally, I wish to thank my parents for their support and encouragement throughout my study.

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# Relation between Boolean Metric Spaces and Boolean Valued Rings

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**Abstract:** In this paper the terms Boolean metric space, Boolean valued rings, Strong Boolean valued rings, weak Boolean valued rings are defined. Example of a Boolean valued ring which is not a weak Boolean valued ring is given. A few theorems to illustrate the relationship between the various kinds of Boolean valued rings and the Boolean metric spaces are established. Examples to illustrate these theorems are given.

**Keywords:** Boolean metric space, Boolean valued rings, Strong Boolean valued rings, weak Boolean valued rings, Translations, motions, Triangle inequality, Relationships between the various kinds of Boolean valued rings and the Boolean metric spaces, Different examples.

## 1. Introduction

The purpose of this paper is to present the essential features of two terms Boolean valued rings and Boolean metric spaces. These has been a continuing interest in abstract metric spaces in which the distances are elements of a set bearing an algebraic structure less restricted than that of the real numbers. The geometric properties and Boolean valuations are discussed in this paper.

**Definition 2.1:** An ordered triple  $(S, B, d)$  is a Boolean metric space where  $S$  is an abstract set,  $B$  is a Boolean algebra, and  $d$  is a mapping from  $S \times S$  into  $B$  satisfying the following conditions:

- $d(x, y) = 0$  if and only if  $x = y$ ,
- $d(x, y) = d(y, x)$
- $d(x, z) \subseteq d(x, y) \cup d(y, z)$  for  $x, y, z$  in  $S$

Here  $B$  is called the distance algebra, the set  $S$  is called the ground set of the space, and the mapping  $d$  is called the distance function or metric. The subset of  $B$  consisting of the function values taken on by  $d$  is called the distance set.

**Definition 2.2:** An ordered triple  $(R, B, \emptyset)$  is a Boolean valued ring, where  $R$  is a ring,  $B$  is a Boolean algebra, and  $\emptyset$  is a mapping from  $R$  into  $B$  satisfying the following conditions:

- $\emptyset(x) = 0$  iff  $x = 0$
- $\emptyset(x + y) \subseteq \emptyset(x) \cup \emptyset(y)$
- $\emptyset(xy) \subseteq \emptyset(x) \cap \emptyset(y)$

**Definition 2.3:** A strong Boolean valued ring is an ordered triple  $(R, B, \emptyset)$ , where  $R$  is a ring,  $B$  is a Boolean algebra, and  $\emptyset$  is a mapping from  $R$  into  $B$  satisfying the following conditions:

- $\emptyset(x) = 0$  iff  $x = 0$
- $\emptyset(x + y) \subseteq \emptyset(x) \cup \emptyset(y)$
- $\emptyset(xy) = \emptyset(x) \cap \emptyset(y)$

**Definition 2.4:** A weak Boolean valued ring is an ordered triple  $(R, B, \emptyset)$ , where  $R$  is a ring,  $B$  is a Boolean algebra, and  $\emptyset$  is a mapping from  $R$  into  $B$  satisfying the following conditions:

- $\emptyset(x) = 0$  iff  $x = 0$
- $\emptyset(x + y) \subseteq \emptyset(x) \cup \emptyset(y)$
- $\emptyset(x) = \emptyset(-x)$

The ring is called a weak Boolean valued ring. In general a Boolean valued ring need not be a weak Boolean valued ring.

**Example 2.5:** Let  $R$  be an ordered integral domain and  $B$  a Boolean algebra with more than two elements. Let  $R'$  be the ring obtained from  $R$  by defining all products to be zero. Let  $b$  be an element in  $B$  such that  $0 \neq b$  and  $1 \neq b$

For  $x \in R'$   
set  $\emptyset(x) = 1$  if  $x$  is negative in  $R$   
and  $\emptyset(x) = b$  if  $x$  is positive in  $R$   
Let  $\emptyset(0) = 0$ .

Then  $(R', B, \emptyset)$  is a Boolean valued ring which is not a weak Boolean valued ring.

The relationship between the various kinds of Boolean valued rings and the Boolean metric spaces which they generate 3.1:

**Theorem 3.2:** Let  $(R, B, d)$  be a Boolean metric space in which all translations  $x \rightarrow x + a$  are motions. Then there exists a weak Boolean valuation  $\emptyset$  for  $R$  such that  $\emptyset(a - b) = d(a, b)$

**Proof:** Let  $(R, B, d)$  be a Boolean metric space in which  $R$  is a ring and in which translations are motions.

Let  $\emptyset(x) = d(0, x)$   
Then  $\emptyset(0) = d(0, 0) = 0$   
and if  $x \neq 0$ , then  $\emptyset(x) = d(0, x) \neq 0$

Since translations are motions  
 $d(-x, 0) = d(-x + x, 0 + x) = d(0, x) = d(x, 0)$   
So that  $\emptyset(x) = \emptyset(-x)$

From the triangle inequality  
 $d(x + y, 0) \subseteq d(x + y, x) \cup d(x, 0)$   
But  $d(x + y, x) = d(x + y - x, x - x) = d(y, 0)$

Since translations are motions  
 $d(x + y, 0) \subseteq d(x, 0) \cup d(y, 0)$   
and  $\emptyset(x + y) \subseteq \emptyset(x) \cup \emptyset(y)$



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Hence  $d(x, y) = d(x - y, y - y) = d(x - y, 0) = \emptyset(x - y)$

Thus  $(R, B, d)$  is the Boolean metric space obtained from  $(R, B, \emptyset)$  by setting  $d(a, b) = \emptyset(a - b)$   
Where  $\emptyset$  is a weak valuation

**Theorem 3.3:** Let  $(R, B, \emptyset)$  be a weak Boolean valued ring .Distance defined as  $d(a, b) = \emptyset(a - b)$ , then  $(R, B, d)$  is a Boolean metric space in which translations are motions.

**Proof:** Suppose that  $(R, B, \emptyset)$  be a weak Boolean valued ring. Set  $d(x, y) = \emptyset(x - y)$

Then  $d(a, a) = \emptyset(a - a) = \emptyset(0) = 0$

If  $a \neq b$ , then  $a - b \neq 0$  and  $d(a, b) = \emptyset(a - b) \neq 0$

Also  $d(x, y) = \emptyset(x - y) = \emptyset(y - x) = d(y, x)$

And  $d(x, y) = \emptyset(x - y) = \emptyset(x - z + z - y) \subseteq \emptyset(x - z) \cup \emptyset(z - y) = d(x, z) \cup d(z, y)$

So the triangle inequality is satisfied and  $(R, B, d)$  is a Boolean metric space.

To show that translations are motions

$d(x + z, y + z) = \emptyset(x + z - y - z) = \emptyset(x - y) = d(x, y)$

**Theorem 3.4:** If  $(R, B, d)$  is a Boolean metric space,  $R$  a ring in which all translations are motions, the following are equivalent

- Ring multiplication decrease distances from the origin  
 $d(xy, 0) \subseteq d(x, 0), d(xy, 0) \subseteq d(y, 0)$  for all  $x, y$  in  $R$
- There exists a Boolean valuation  $\emptyset$  for  $R$  such that  
 $d(a, b) = \emptyset(a - b)$
- Ring multiplication are contraction mappings  
i.e  $d(xz, yz) \subseteq d(x, y)$   
 $d(zx, zy) \subseteq d(x, y)$  for all  $x, y, z$  in  $R$

**Proof:** (i)  $\Rightarrow$  (ii)

Let  $(R, B, d)$  be a metric space in which translations are motions and (i) is satisfied.

Let  $\emptyset(x) = d(x, 0)$ .

By the theorem 3.3  $(R, B, d)$  is determined by the weak Boolean valued ring  $(R, B, \emptyset)$  setting  $d(a, b) = \emptyset(a - b)$

But since condition (i) is satisfied

$d(xy, 0) \subseteq d(x, 0)$  and

$d(xy, 0) \subseteq d(y, 0)$

Hence  $d(xy, 0) \subseteq d(x, 0) \cap d(y, 0)$  and

$\emptyset(xy) \subseteq \emptyset(x) \cap \emptyset(y)$

So that  $(R, B, \emptyset)$  is a Boolean valued ring.

(ii)  $\Rightarrow$  (iii)

By definition  $d(xz, yz) = \emptyset(xz - yz)$

$\emptyset(xz - yz) = \emptyset((x - y)z) \subseteq \emptyset(x - y) \cap \emptyset(z) \subseteq \emptyset(x - y) = d(x, y)$

Similarly the other inequality can be established.

(iii)  $\Rightarrow$  (i)

This can be established, by taking either  $x$  or  $y$  be 0

**Theorem 3.5:** If  $(R, B, d)$  is a Boolean metric space satisfying the conditions of theorem 3.4, where  $R$  is a ring with unit, the following are equivalent.

- Ring multiplications are similarity transformations with respect to the origin (for every  $x$  in  $R$ , there is an element  $b(x)$  of the distance set such that  $d(xz, 0) = d(z, 0) \cap b(x)$  for all  $z \in R$ )

b) There exists a strong Boolean valuation  $\emptyset$  for  $R$  such that  
 $d(a, b) = \emptyset(a - b)$

c) Ring multiplications are contraction mappings with fixed constant of contraction ( $z$  in  $R$  implies the existence of  $c(z)$  in the distance set such that  $d(xz, yz) \subseteq d(x, y) \cap c(z)$  for all  $x, y$  in  $R$ )

**Proof:** (i)  $\Rightarrow$  (ii)

From (i) it follows that for fixed  $x$  and all  $z$ ,

$d(xz, 0) = d(z, 0) \cap b(x)$

Let  $\emptyset(x) = d(x, 0)$ .

Then by Theorem 3.4  $\emptyset$  is a Boolean valuation

Hence  $d(x, 0) = d(x, 1, 0) = d(1, 0) \cap b(x) = \emptyset(1) \cap b(x)$

Thus  $\emptyset(x) = \emptyset(1) \cap b(x)$

But  $b(x) = \emptyset(t)$  for some  $t \in R$ , so that  $\emptyset(x) = \emptyset(1) \cap \emptyset(t)$

And hence  $\emptyset(x) \subseteq \emptyset(1)$

implies that  $\emptyset(1) \cap b(x) = \emptyset(1) \cap \emptyset(t) = \emptyset(x)$

$\therefore b(x) = \emptyset(x)$

$\emptyset(xz) = d(xz, 0) = d(z, 0) \cap b(x) = d(z, 0) \cap \emptyset(x)$   
 $= \emptyset(z) \cap \emptyset(x)$

And  $\emptyset$  is a strong Boolean valuation

(ii)  $\Rightarrow$  (iii)

Let  $z$  be fixed, then  $d(xz, yz) = \emptyset(xz - yz) = \emptyset(x - y) \cap \emptyset(z) = d(x, y) \cap \emptyset(z)$ .

By letting  $y = 0$  we can establish that (iii)  $\Rightarrow$  (i)

**Example 3.6:** A Boolean metric space  $(R, B, d)$ ,  $R$  a ring, in which translations are not motions

Let  $(R, B, d)$  be a Boolean metric space in which  $R$  is a Boolean ring with identity,  $B$  is the Boolean algebra associated with  $R$ , and  $d(a, b) = a - b$

Select distinct elements  $x, y$  such that  $d(x, y) \neq 1$

Let  $a$  be a fixed non-zero element of  $R$  with  $a \neq x + y$ .

Define the function  $d'$  as follows:

$d'(b, c) = d(b, c)$  if  $b \neq x + a, c \neq x + a$

$d'(x + a, b) = d'(b, x + a) = 1$  if  $b \neq x + a$

$d'(x + a, x + a) = 0$

Then  $(R, B, d')$  is a Boolean metric space, but  $d'(x + a, y + a) = 1 \neq d'(x, y)$

**Example 3.7:** An example of a Boolean valued ring which is not a strong Boolean valued ring.

Consider the Boolean valued ring  $(R, B, \emptyset)$  where  $R$  is a ring with divisors of zero and  $B$  is the two element Boolean algebra.

Let  $\emptyset(x) = 1$

if  $x \neq 0$  and  $\emptyset(0) = 0$  Then if  $xy = 0$ , and  $x, y \neq 0$ ,

$\emptyset(xy) = 0$ , but  $\emptyset(x) \cap \emptyset(y) = 1 \cap 1 = 1$ .

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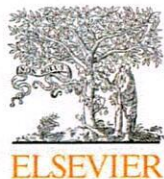


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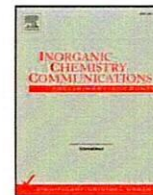
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# Inorganic Chemistry Communications

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## Synthesis, characterisation, cytotoxicity, DNA binding and antimicrobial studies of binary and ternary metal complexes of Co (II)



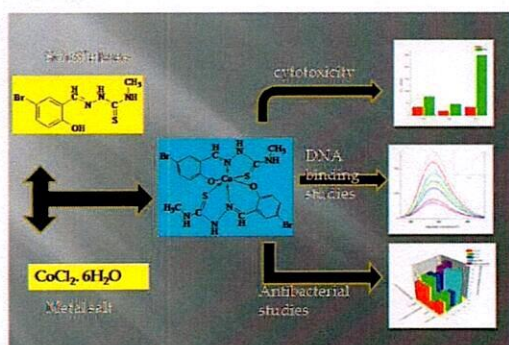
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### GRAPHICAL ABSTRACT



### ARTICLE INFO

#### Keywords:

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### ABSTRACT

A series of Schiff's base ligand metal complexes of Co (II) with binary, formulae [Co (L)<sub>2</sub>] (mc-a), and ternary, formulae [Co(L) (L<sub>1</sub>) (H<sub>2</sub>O)] (mc-b), [Co (L) (L<sub>2</sub>) (H<sub>2</sub>O)] (mc-c) where L is (2Z)-2-(2-Hydroxy-5-BromoBenzylidene) Hydrazine N-methyl Carbo-Thioamide (Schiff's base ligand), L<sub>1</sub> is Ethylene Diamine and L<sub>2</sub> is Bipyridine were synthesized. The metal complexes have been characterized by Mass spectra, UV-Vis absorption, Magnetic susceptibility, FT-IR, SEM, and Powder XRD. The Schiff's base had been further identified by <sup>1</sup>H NMR. The complexes have been evaluated for their cytotoxicity, DNA binding studies, and antimicrobial studies. The cytotoxic results found that the metal complexes showed IC<sub>50</sub> values around 17.77–249.12 µg/ml. The DNA binding constants (k<sub>b</sub>) of the metal complexes were determined as, 0.9 × 10<sup>4</sup> M<sup>-1</sup>, 0.5 × 10<sup>4</sup> M<sup>-1</sup>, 2.0 × 10<sup>4</sup> M<sup>-1</sup> for mc-a, mc-b, mc-c respectively, indicating that the complexes strongly bind to DNA. Furthermore, these complexes showed significant activity against some bacteria & fungi.

### 1. Introduction

The chemistry of Schiff's base is an important area of research with increasing interest due to their simple synthetic process, versatility, easy possible and application for their metal complexes [1].

Thiosemicarbazides and their metal complexes display a wide range of biological activities such as antitumor, antibacterial, antiviral and anti-malarial activities [2,3]. Ligands having Oxygen, Nitrogen, and Sulphur as donors are widely studied to their complexes cover many areas spacing from the effect of S and electron delocalization in Transition

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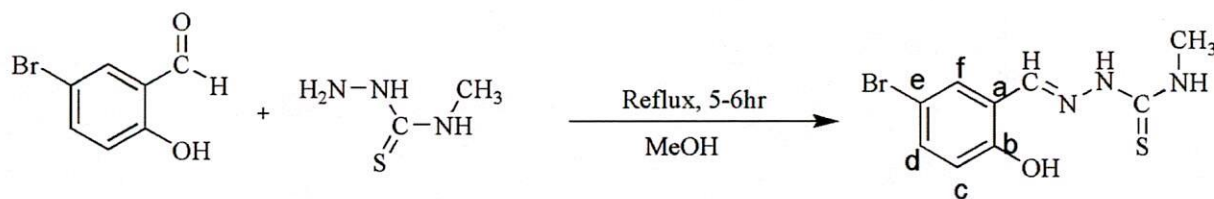
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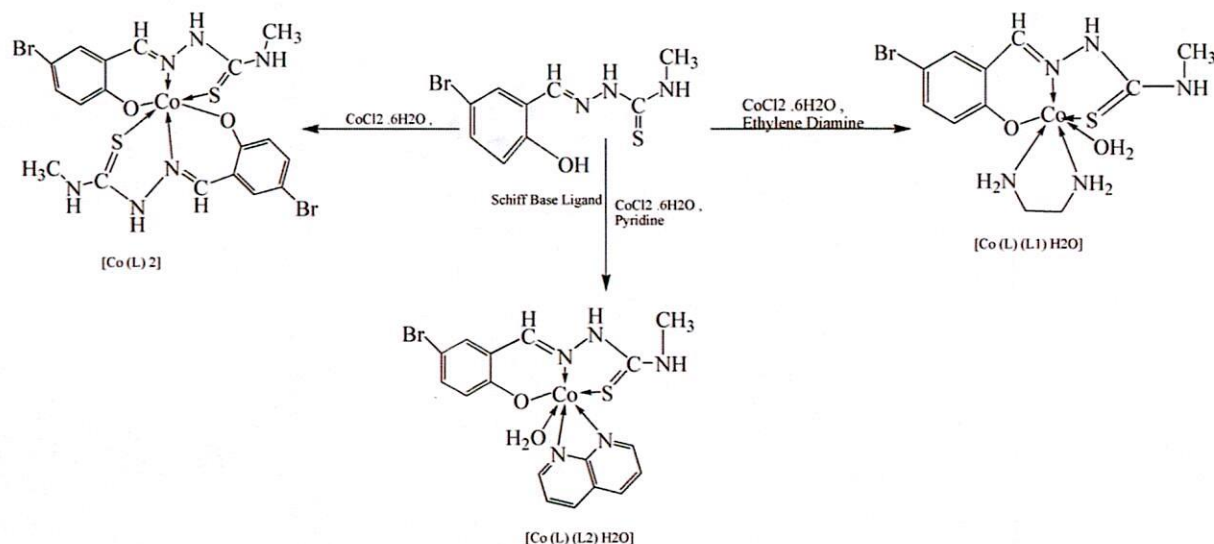
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Scheme 1. Synthetic route and structure of Schiff's base ligand.



Scheme 2. Preparation of metal complexes.

Metal complexes [4]. Earlier studies had proven that transition metal complexes of Thiosemicarbazides are a very powerful antitumor agent than the free ligand.

Cytotoxicity study of the Schiff's bases has been receiving considerable attention ever since their effectiveness at inhibiting proliferation of cells [5]. On the other hand use of Cisplatin, a medically recognized antitumor drug, causes numerous side effects, which remains a challenge to overcome and to prepare efficient anticancer drugs for new chemotherapeutics [6].

Many transition metal complexes can bind and notch ds-DNA in a physiological environment [7,8]. DNA binding studies of metal complexes are a significant primary issue in life sciences and are very important in the investigation of DNA molecular probes and new therapeutic reagents [9–11]. The non-covalent interactions including intercalative, electrostatic and groove binding are the possible binding modes of the complexes to the DNA.

In present work we have studied on the synthesis, characterization, cytotoxicity, DNA binding studies of Primary and Ternary Co (II) complexes. DNA binding studies were studied by absorption spectra, fluorescence spectral studies. Cytotoxicity experiments have been done against HeLa & MCF7 cell lines using MTT assay. The complexes were characterized by different spectral methods and also subjected to antimicrobial studies.

## 2. Experimental

### 2.1. Synthesis of Schiff base ligand

The Schiff's base ligand "(2Z)-2-(2-Hydroxy-5-Bromo Benzylidene) Hydrazine N-Methyl Carbo-Thioamide" (L) has been synthesized by the method that has been reported earlier by Aamer Saeed, Najim et al. [12]. Methanolic solution of (40 ml) N-Methyl Thiosemicarbazide (2.10 g, 0.02 mol) and few drops of sulphuric acid were added to a Methanolic solution of 5-Bromo Salicylaldehyde (3.13 g, 0.02 mol). The

resultant mixture was refluxed for 3 h; the resulting solid product was isolated by filtration and recrystallized from methanol. Yield 80%; ESI-MS(DMSO):  $m/z = 286$  (calcd.286) (M); IR (KBr,  $\text{cm}^{-1}$ ):1627 (C=N), 1475 (C=C), 1654(-CH=N), 3275(-NH), 3390(-OH);  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ , ppm): 7.8–8.0 (d,  $\text{H}_c$ , 1H), 8.0–8.2 (d,  $\text{H}_d$ , 1H), 8.3–8.5 (s,  $\text{H}_f$ , 1H), 9.0–9.5 (s, -OH, 1H), 3–3.5 (s, -NH, 2H), 1.5–2.0 (s, -CH, 1H), 1.0–1.5 (s, -CH<sub>3</sub>, 3H) (Scheme1) Figs. S1 and S2.

### 2.2. Synthesis of complexes

#### 2.2.1. Synthesis of [Co(L)<sub>2</sub>] complex

This complex was prepared by mixing  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  (1 mM) in MeOH (50 ml) and Schiff's base (L) (1 mM) in 15 ml methanol in a 1:2 ratio and the mixed solutions refluxed for 2–5 h at 70–80 °C. The product was separated and washed with ethanol and dried in vacuum. Yield 80%; ESI-MS (DMSO):  $m/z = 631$  (calcd.630) (M+1). Fig. S3.

#### 2.2.2. Synthesis of [Co(L)(L<sub>1</sub>)H<sub>2</sub>O] complex

This complex was prepared by mixing  $\text{CoCl}_2 \cdot 0.6 \text{H}_2\text{O}$  (1 mM) in MeOH (50 ml) and Schiff's base (1 mM) in 15 ml Methanol. This mixture was refluxed for 2 h. To this mixture Ethylene Diamine (1 mM) in 15 ml methanol was added and refluxed at refluxing temperature for 3 h. The resulting product was filtered, washed with cold ethanol and dried in Vacuum. Yield 75%; ESI-MS (DMSO):  $m/z = 467$  (calcd.428) (M+K). Fig. S4.

#### 2.2.3. Synthesis of [Co(L)(L<sub>2</sub>)H<sub>2</sub>O] complex

This complex was prepared by mixing  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  (1 mM) in MeOH (50 ml) and Schiff base (1 mM) in 15 ml Methanol and allowed to reflux for 2 h. To this mixture Bipyridine (1 mM) in 15 ml methanol was added and refluxed at refluxing temperature for 3 h. The resulting precipitate was filtered, washed with cold ethanol and dried in Vacuum (Scheme 2). Yield 76%; ESI-MS (DMSO):  $m/z = 518$  (calcd.518) (M). Fig. S5.

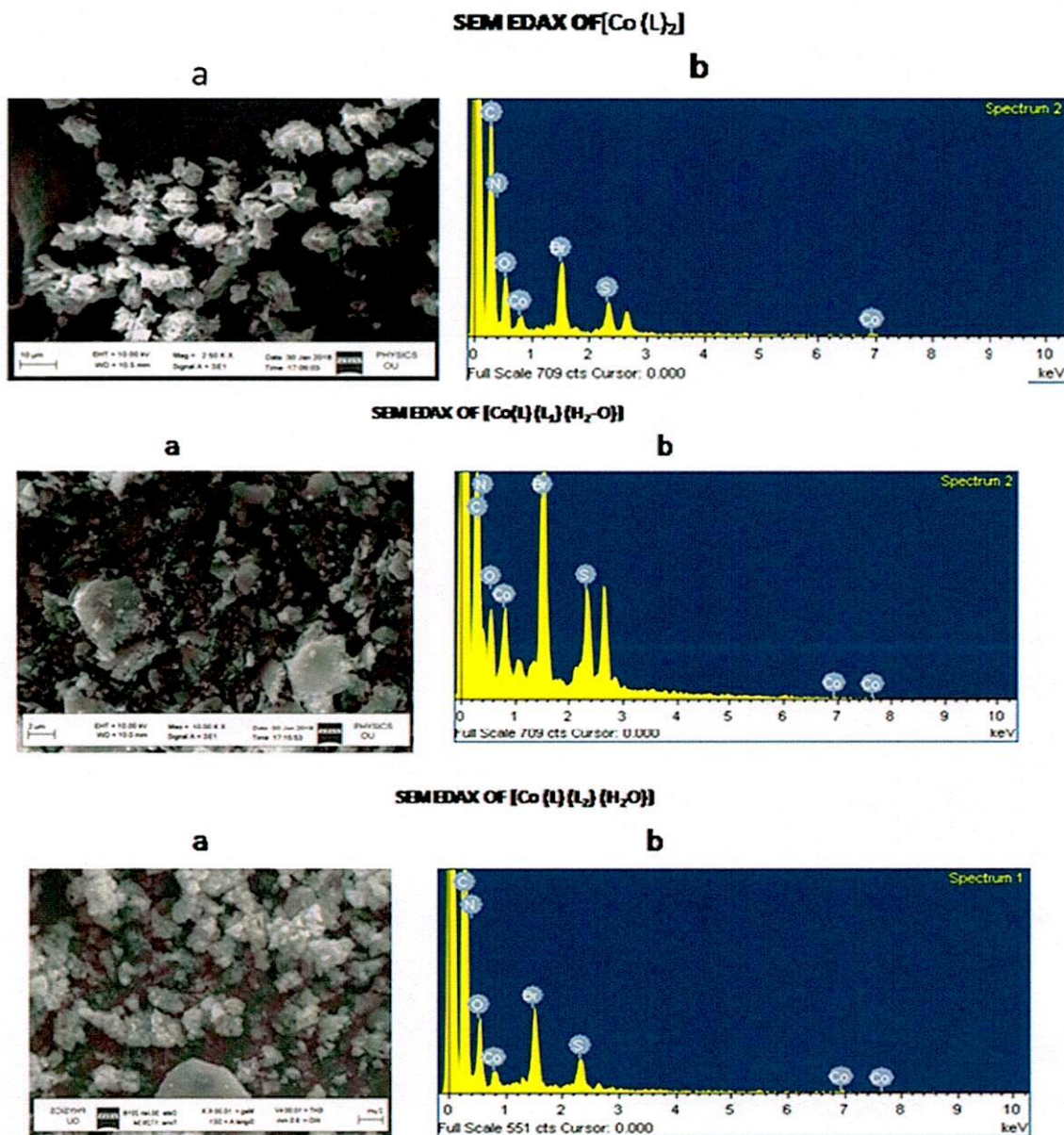


Fig. 1. (a) Images of scanning electron microscopy (SEM) (b) Energy-dispersive X-ray spectroscopy (EDAX) of the metal complexes for mc-a, mc-b, mc-c from the top to bottom respectively.

### 3. Results and discussion

#### 3.1. FT-IR analysis & mode of bonding

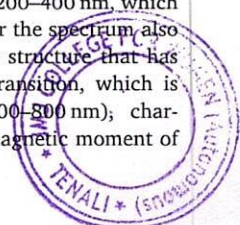
The IR spectra of a free ligand exhibited a broadband at  $3390\text{ cm}^{-1}$  corresponding to phenolic OH group which was found disappeared in the IR spectra of metal complexes, indicating co-ordination through phenolic hydroxyl group and another important band in the IR spectra of ligand appeared at  $1552\text{ cm}^{-1}$  due to C=N group stretching vibration which was shifted to the extent of  $10\text{--}20\text{ cm}^{-1}$  upon complexation implying its coordination via azomethine nitrogen to the metal centre [13,14]. Additionally, the strong band observed at the  $1267\text{ cm}^{-1}$  due to C=S stretching vibrations in the ligand spectrum were found to be shifted about  $1284\text{--}1288\text{ cm}^{-1}$  in the IR spectra of metal complexes indicating the involvement of the thioketo sulphur in the co-ordination. Further, the formation of complexes was also ascertained by the presence of medium intensity bands in the region  $576\text{--}578\text{ cm}^{-1}$  and  $468\text{--}470\text{ cm}^{-1}$  and  $372\text{--}439\text{ cm}^{-1}$  assigned to  $\nu(\text{Co-O})$ ,  $\nu(\text{Co-N})$  and  $\nu(\text{Co-S})$  respectively.

Further the appearance of broadband around  $3370\text{--}3480\text{ cm}^{-1}$  and weaker bands around  $800\text{--}860\text{ cm}^{-1}$  range, which could be assigned to OH stretching, rocking & wagging vibrations respectively indicating the presence of water molecule that coordinated to the Co (II) metal ion in the complexes [15] which also supported by elemental analysis. Figs. S6–S9.

The important absorption frequencies of all metal complexes with the ligand and their assignments are listed in Table 1

#### 3.2. Magnetic moments & electronic spectral data

The electronic spectral data gives information regarding the geometry of metal complexes. The diffuse reflectance spectrum of the Co (II) metal complexes showed bands in the region of  $200\text{--}400\text{ nm}$ , which is indicative of charge transfer transitions. Moreover the spectrum also exhibits one broadband with the considerable fine structure that has intensities consistent with the spin allowed d-d transition, which is attributed to transitions  $\nu_1[(T_{1g}(F) - T_{2g}(F))]$  ( $700\text{--}800\text{ nm}$ ); characteristic of an octahedral geometry [16] further magnetic moment of



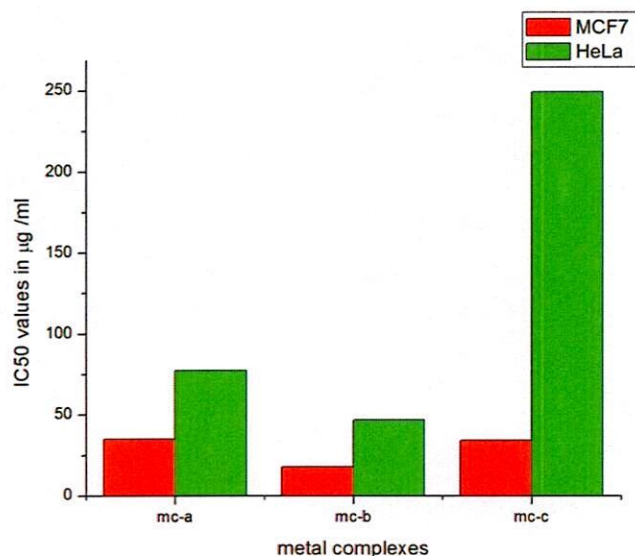


Fig. 2. Cytotoxic activity of metal complexes showing  $I_{c50}$  values in  $\mu\text{g/ml}$  against HeLa and MCF7 cell lines.

4.8B.M also suggest an octahedral symmetry. On the other hand, ligand shows peaks in the region of 200–400 nm which are assigned to INCT transitions. Figs. S10–S13.

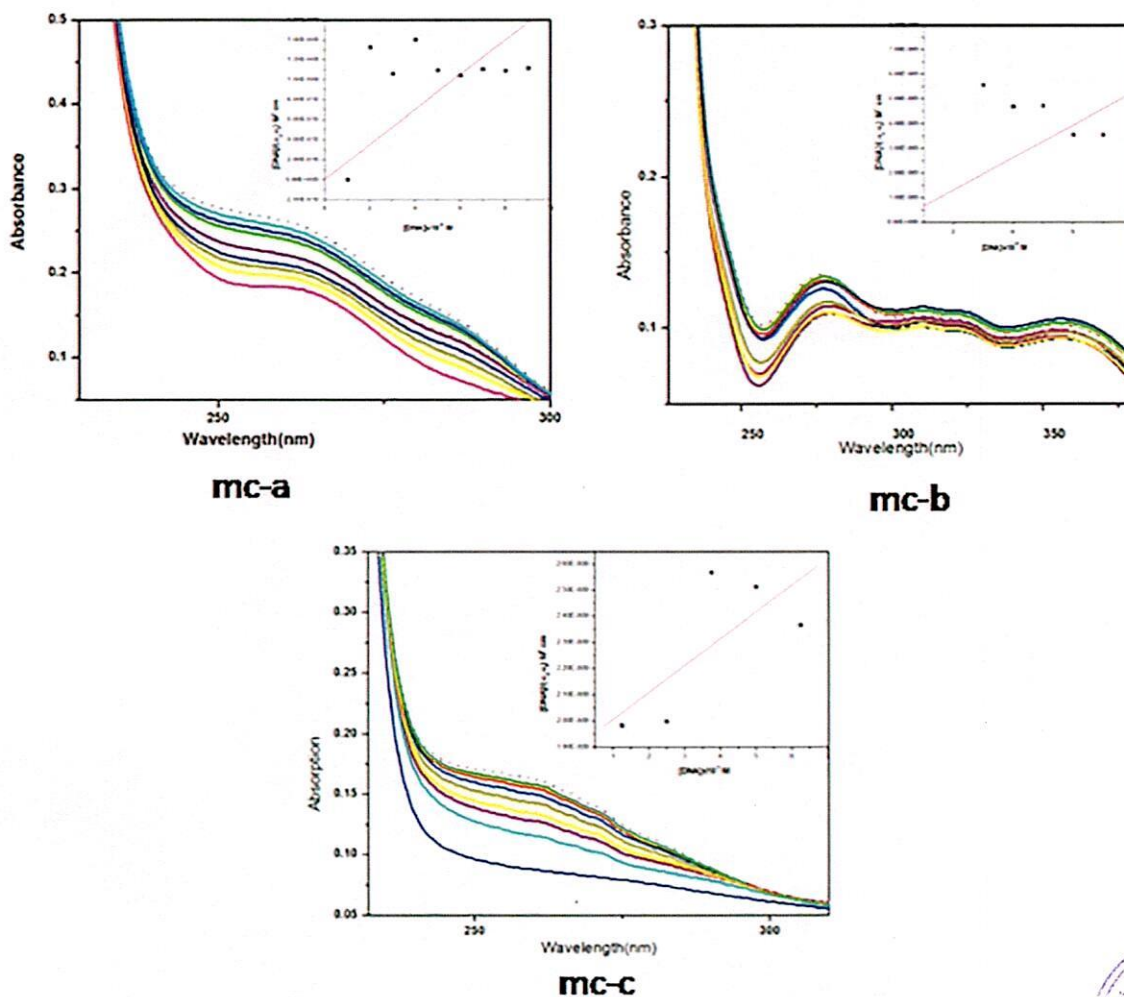


Fig. 3. Electron spectra of three metal complexes in the absence and presence of increasing amounts of CT-DNA, DNA = 10–100  $\mu\text{M}$ . Inset: Linear plots for the calculation of intrinsic binding constant  $K_b$ .

### 3.3. XRD analysis

To obtain extra support about the structure of the metal complexes X-ray diffraction was performed. The diffractograms obtained for the metal complexes are given in (Fig. S14). The powder XRD of complexes showed sharp crystalline peaks indicating its crystalline phase which may be attributed to the formation of a well defined distorted crystalline structure. Probably this behaviour is due to the incorporation of water molecules into the coordination sphere.

### 3.4. SEM analysis

The particle size, purity, morphology and the surface structure of the synthesized metal complexes have been shown from the Scanning Electron micrograph (SEM).

The SEM images revealed the metal complexes having the particle are agglomerated with the controlled morphological structure and the presence of irregular spherical structures in complexes (Fig. 1). “However, particle sizes less than 100 nm were also observed, which groups to form agglomerates of larger size”. The elemental composition of shown in EDX spectra (Table 2)

### 3.5. Cytotoxic study

An in vitro cytotoxic study is valuable tool in the screening of chemotherapy agents and procures a preliminary data for further

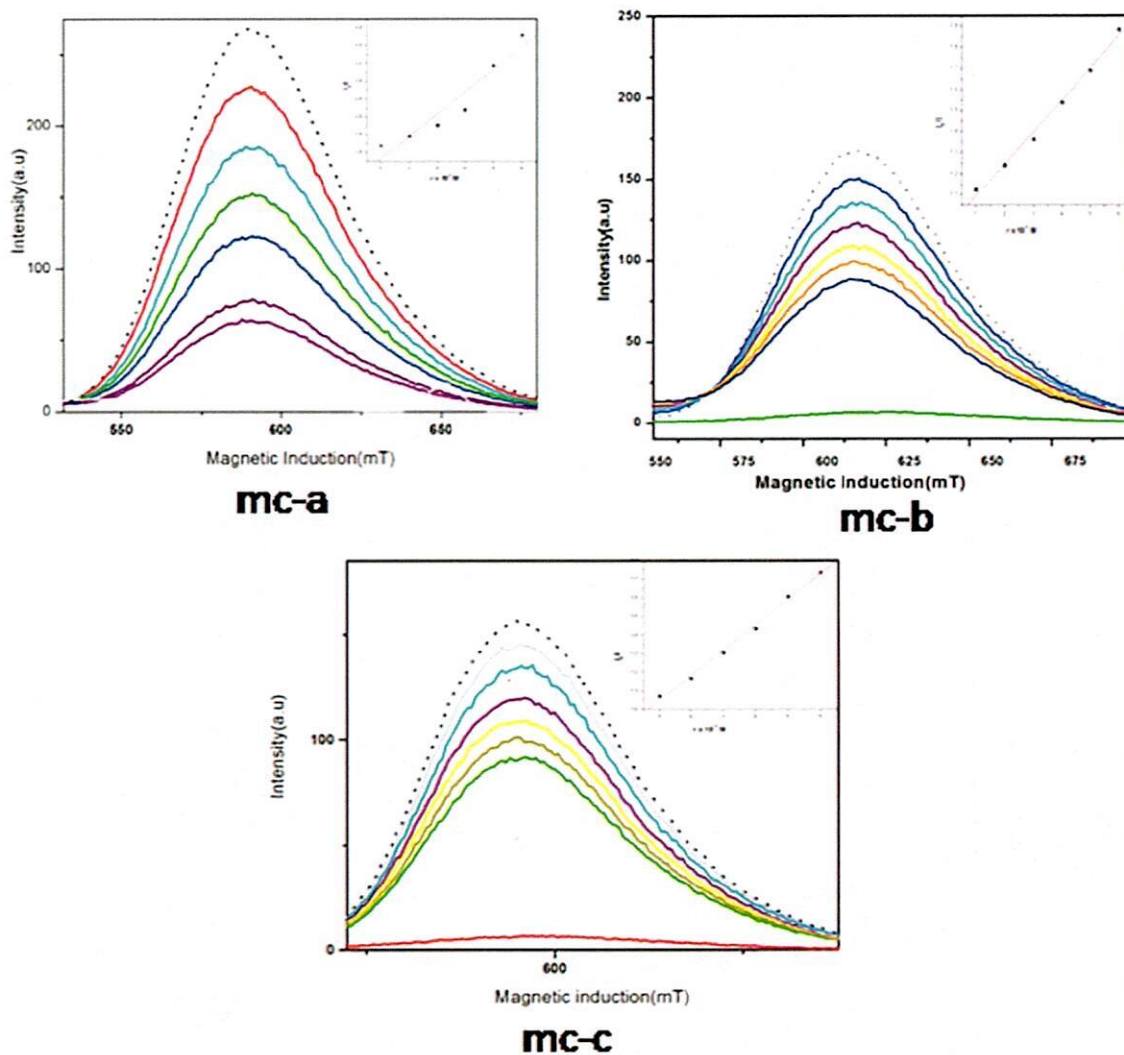


Fig. 4. Emission spectra of EB bound to DNA in the absence and presence of complexes (100  $\mu$ M) Inset: Stern-Volmer quenching curves.

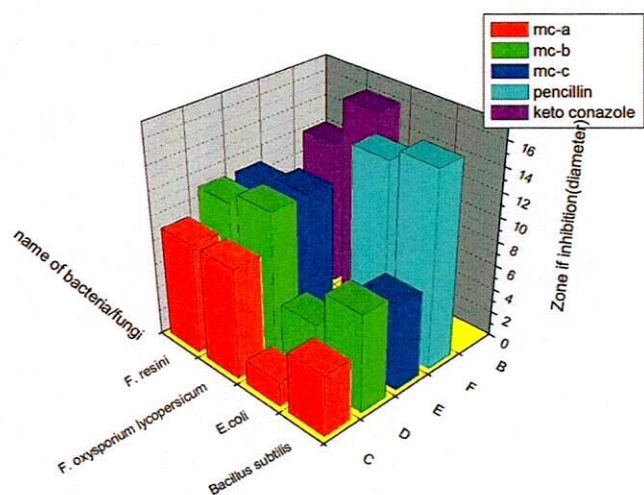


Fig. 5. Antibacterial and antifungal activity of metal complexes comparing with standards.

studies.

The cytotoxic activity of all metal complexes was examined on HeLa & MCF7 cell lines adopting MTT assay. It depends on their ability to bind DNA and damage its structure resulting in the impairment of its

function which is followed by replication and transcription process inhibition and eventually cell death i.e. what we can suppose [17].

The results were analyzed by cell viability curves and given with IC<sub>50</sub> values. The % of inhibition on the tested cell lines in the compound concentration range of 5–100  $\mu$ g/ml is given in Tables 4–6. According to the result as the concentration of compound increased, the cell viability is decreased, the viability of cells incubated without any compound was considered as 100%.

The IC<sub>50</sub> values obtained in this study are listed in Table 3. From the Table 3 it is to be observed that metal complex-a, metal complex-c are found to behave as a good antitumor agent on MCF7 & HeLa respectively (Fig. 2). Hence the higher cytotoxicity had shown by the complexes may be due to relatively stronger interacting ability of the complexes with DNA [18].

### 3.6. DNA binding studies

#### 3.6.1. Electron absorption study

Electron absorption spectroscopy was used to determine the binding characteristics of metal complexes with DNA. The binding of Co (II) complexes to the DNA helix was characterized by resulting hypochromic in intensity and red shift in wavelength due to strong stacking interaction between an aromatic chromophore and the base pairs of DNA [19,20] indicates intercalative mode of binding. "The electronic absorption spectra consisting of all metal complexes are shown in

(Fig. 3)". The intrinsic binding constant  $k_b$  is calculated from a plot of  $[DNA]/(E_a - E_f)$  Vs  $[DNA]$  using equation.

$$[DNA]/(E_a - E_f) = [DNA]/(E_b - E_f) + 1/k_b(E_b - E_f)$$

where  $E_a$ ,  $E_f$  and  $E_b$  are the compound in the presence of DNA, free compound and fully DNA-bound compound respectively [21]. The  $k_b$  values for metal complexes are found to be  $0.9 \times 10^4 M^{-1}$  for mc-a,  $0.5 \times 10^4 M^{-1}$  for mc-b,  $2.0 \times 10^4 M^{-1}$  for mc-c. With increasing DNA concentration, "the resulting tendency to hypo chromic and slight red shifts indicates that the complexes can bind with DNA through intercalative mode". However, the binding affinity of all the complexes against CT-DNA is less than that of potential intercalators like ethidium bromide [EB] [22].

### 3.6.2. Fluorescence study

Fluorescence experiments were performed to get proof for the mode of binding of metal complexes with DNA. The relative binding ability of metal complexes with DNA has been investigated by Ethidium Bromide (EB) displacement method. EB is one of the most useful fluorescent probes that bind to DNA through intercalation and there is an enhancement in the intensity of fluorescent spectra of EB in the presence of DNA [23]. The experiment results showed that by the addition of metal complexes to EB-DNA, there is a decrease in the intensity of EB-DNA due to complex competitive binding to the EB-bound DNA system by displacement of bound EB from DNA [24]. As shown in (Fig. 4), the fluorescence intensity at 590 nm decreased gradually on the increasing concentration of metal complexes. The results showed that all the compounds bind with DNA by the intercalation mode.

These results are expressed in terms of quenching constant  $K_{SV}$  calculated from equation  $I_0/I = 1 + K_{SV}$ . The relative binding constants of the complexes are found to be in between  $1.4$  and  $3.1 \times 10^4 M^{-1}$ . From the results metal complex-c can bind DNA strongly than the other complexes, consistent with the absorption spectral results were shown in the order mc-c > mc-a > mc-b.

### 3.7. Antimicrobial activity

The synthesized metal complexes were tested for antibacterial activity against the gram-positive bacteria of *Bacillus subtilis* and one gram-negative bacterium of *Escherichia coli* "which were spread on different plates nourished with nutrient agar". The results of the antimicrobial activity of the metal complexes are displayed in a Table 7. Ampicillin was taken as the positive control (standard) drug for the measurement of a zone of inhibition (in mm). The metal complexes had shown referable anti-bacterial activity (Fig. 5). Metal complex-c showed the highest zone of inhibition. The metal complexes were also screened for their antifungal activity against *Fusarium Oxysporium*, *Lycopersicum* and *Fusarium Resini*. Interestingly the prepared metal complexes exhibited prominent antifungal activity against all fungi than antibacterial with significant inhibition zone (diameter). It attributed to the fact that the lipid membranes that surround the cell favour the passage of only lipid-soluble materials which make liposolubility, an important factor that controls antibacterial activity. On chelating with metal ions, the polarity of metal ion will be reduced to a greater extent due to an overlap of ligand orbital and partial sharing of the positive charge of the metal ion with donor groups. Furthermore, the chelating increases the delocalization of p-electrons over the whole chelating ring and also enhances the lipophilicity of the metal complexes [25].

## 4. Conclusion

In this paper, we reported the synthesis of Schiff's base ligand & its

complexes of Co(II) and characterization by elemental data and spectral analysis. SEM analysis of metal complexes revealed their homogenous nature. The binding mode of complexes with CT-DNA was evaluated by UV-Visible absorption spectroscopy & Fluorescence studies. The results strongly favour the binding of the complex with CT-DNA via intercalation mode.

In MTT assay, cytotoxicity studies, the complexes exhibited anticancer activity against MCF7 and HeLa cancer cells effectively. Additionally, all the complexes are screened for antibacterial and antifungal activities and it has observed that all complexes had shown high antifungal activity than antibacterial activity.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.inoche.2019.107590>.

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## Health Care in Women with Gestational Hypertension on Evaluation of Pregnancy

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### ABSTRACT

**HISTORY:** Gestational excessive blood strain complicates as much as approximately 10-15% of all the pregnancies and it's far related to excessive danger of contrary fatal, neonatal, and maternal consequences. **Aim:** compare the being pregnant results among girls with gestational high blood strain and its relation to furnished care. check layout: Quantitative descriptive layout putting: King Abdul-Aziz college medical institution and Maternity and kids medical institution Sampling: The sample have emerge as a useful sample that includes the gestational high blood stress, preeclampsia and eclampsia women, who fulfil the inclusion requirements and admitted to the said placing in the path of information collection time and agree to take part. look at length: From September 2013 till April 2014. gadget: 1- assessment sheet 2- The pregnancy consequences tick list. results: The maternal very last outcomes in this have a have a study recorded no deaths, but; the various taking element ladies 38.3% had excessive complications. (fifty 8.three%) of women delivered with the resource of caesarian phase, (35%) had preterm deliveries, (7.7%) had cardiovascular headaches, (five%) had HELLP syndrome and (three.3%) had PPH. however, sixty six.7% of the neonates have been complicated. 35% of the infants had untimely beginning, even as one child IUID and one neonatal lack of lifestyles cease: every lethal and maternal headaches were maximum on the equal time as nursing care changed into not executed. but, take a look at findings suggests that the supplied care to the gestational hypertensive girls turn out to be not completely consistent with global pointers of gestational immoderate blood strain manipulate. advice: take a look at honestly indicates the want to prepare persevering with nursing schooling and training workshop for all of the nurses and innovate a smooth protocol in coping with gestational excessive blood strain lady.

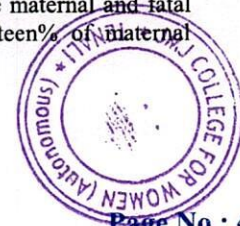
**Keywords:** Gestational excessive blood pressure, Definition, provided Care, being pregnant very last outcomes, Preeclampsia, Eclampsia

**Introduction:** Gestational high blood pressure is taken into consideration the maximum commonplace medical problem sooner or later of pregnancies (1) and constitutes one of the complications which have an effect on 6-8% of pregnancies Gestational

excessive blood pressure and pre-eclampsia is related to preterm shipping, intra uterine increase retardation and prenatal loss of life. excessive pre-eclampsia has the functionality for development to eclampsia, placental abruption, excessive haemorrhage, multi-organ failure (4). It additionally ends in caesarean delivery, thrombocytopenia, cerebral edema, liver insufficiency, sub capsular liver hematoma, renal failure, and disseminated intravascular coagulation (DIC) (5)(6). most maternal deaths and headaches are because of lack of sources (which encompass health care, schooling and budget), deficiencies in antenatal care, ineffective prevention strategies, beside the aspect analysis and manage of patients with preeclampsia or eclampsia. but, pregnancies stricken by hypertensive disorders want cautious monitoring because of the better risk of headaches (7). Maximum of these headaches may be decreased by using manner of early detection and proper management (eight) (9). Correspondingly, nurses have an crucial function within the prevention of gestational immoderate blood stress complications, and collaboration within the early detection and suitable management of those problems to decrease the unfavourable results to each mom and infant. As moreover, manipulate of preeclampsia and eclampsia calls for informed and quite skilful nurses for assessing the ladies'' desires and troubles, and imparting appropriate nursing care to keep their lives (nine).

### Significance of study:

Gestational excessive blood stress is one of the not unusual conditions of unknown aetiology as a way to growth the maternal and fatal morbidity and mortality (10) at some point of the look for articles about Gestational excessive blood pressure, the researcher found that there had been few Saudi based totally definitely sincerely research, which moreover made the researcher particularly advocated and greater worried to conduct this research. So, the researcher's cause modified into to utilize the have a look act's findings to boom the overall care of pregnant hypertensive girls. (2) As an alternative, preeclampsia and eclampsia have an effect on approximately 10% of pregnant girls, inflicting notable maternal and fatal morbidity and contributing to fifteen% of maternal mortality (3)



**Material and methods****Research design / setting:**

A quantitative descriptive test changed into finished at essential hospitals in Jeddah metropolis, Saudi Arabia. The number one hospital is the Maternity and youngsters' health facility (MCH) Al-Mousaa'dya branch, the main middle in obstetrics and gynaecology area of expertise inside the western location of the beneath the Ministry of fitness, The bed ability of the hospital changed into 254 (eleven) the second one is King AbdulAziz college health facility (KAUH), a Ministry of training facility it honestly is a number one coaching hospital in Jeddah allotted within the southern place of Jeddah. The bed capability of the health facility became 1002 (12).

**Research Instrument:**

The devices that used inside the modern take a look at are 1-assessment sheet 2- The being pregnant final results checklist. the primary tool on this have a examine aimed to assess the ladies' demographics, clinical records and the healthcare provided. It includes elements: detail

A. Demographic and scientific information assessment sheet (researcher administered questionnaire). It become advanced with the useful resource of the researcher primarily based mostly on evaluate of applicable, present day and updated literature Elements.

B. The fitness care provided inventory tick list .This checklist have come to be tailor-made from the use business enterprise for global development and the Maternal and toddler health integrated software (13). it is an American assessment tick list, published and used with gestational hypertensive girls.

**Sampling:**

A purposive sampling approach turn out to be used to recruit ladies in modern have a look at. The sampling requirements covered ladies with gestational excessive blood strain, (moderate- slight - severe preeclampsia and eclampsia), who have been admitted in previous stated putting. They were 20 to 45 years antique, who started out their being pregnant with normal blood and did not have arterial blood stress above a hundred and twenty/eighty mmHg at some stage in facts series. All ladies had everyday visits or at least 4 visits during pregnancy, unmarried fetus, gestational age 34 weeks or greater & without any one-of-a-kind persistent medical disease or obstetrical headaches in the route of their cutting-edge pregnancy.

**Data collection process**

The records series technique has been taken via 2 ranges: section 1. Approaching women phase: 2.follow up

**Approaching women phase:**to begin with, ladies had been approached inside the natal ward 4 times

consistent with week from every hospital 2. Researcher used the admission to pick out instances that fulfilled the inclusion requirements .three. The times have been assigned to one of the gestational excessive blood stress categorized relying on ladies' clinical data (BP reading, protein diploma and edema scale) .4. Researcher finished the assessment shape through interviewing and asking the women which took about 20 to half-hour. ultimately, the researcher documented any kind of care furnished to the women ultimately of hospitalization after which completed element 2 of the evaluation shape via reviewing the medical report. The supplied care findings were classified into finished, in part finished or no longer executed.

**Follow up phase:** The researcher observed up mom and infant's condition after transport every by smartphone call or checking the submit-natal list inside the obstetric unit to finish the pregnancy outcome tick list

**Statistical assessment:**

The Statistical bundle for Social Sciences (SPSS) software utility version 22.zero grows to be used for statistics access and assessment. Descriptive information and assessments of significance for attempting out the affiliation of variables difference in the observe

**Ethical consideration**

First rate permission has become received from the ethical Committee of the Nursing university at KAU next permission become obtained from both hospitals' committees to provoke information series with complete admire for the privacy of player's.

**RESULT:**

At complete of 60 girls had been blanketed inside the observe with 30 of them categorized as gestational high blood strain and mild to mild preeclampsia, 26 with excessive preeclampsia and 4 with eclampsia. Desk 1: indicates that the age of just about half of ofof people (forty six.7%) turn out to be much less than 30 years. Their recommend +SD modified into 32+9.7 years. about half of individuals (fifty one.7%) had number one education, 38.three% had college education, at the equal time as 10% had been illiterates. greater than thirds of individuals were housewives (sixty eight.three%), 10% were college students and 21.7% were hired. desk 2 suggests that 35% of contributors have been primigravidas, 36.7% had 2-five pregnancies, while 28.three% had extra than 5 pregnancies. a couple of zero.33 of members (38.three%) had been nulliparous, 35% had 1-three deliveries, even as 26.7% had four or greater preceding deliveries. One fifth of participants (20%) had one previous abortion, while 15% had 2 or extra abortions. desk 3 indicates that half of player women with gestational immoderate blood pressure had

moderate to slight pre-eclampsia (50%), 40 3.3% had excessive pre-eclampsia, at the identical time as 6.7% had eclampsia, half of of members had +1 edema (50%), 28.3% had +2 edema, 16.7% had +three edema , while five% had +4 edema.

1. Systolic blood pressure: 140-160 mmHg; diastolic blood pressure: 90-110 mmHg

2. Diastolic blood pressure: 110 mm Hg or more and proteinuria 3+ or more

3. Pregnant woman became unconscious or had convulsions, diastolic BP 110 mmHg or more, proteinuria 2+ or more

**Table 4** shows that approximately one 1/3 of contributors (36.7%) underwent spontaneous normal vaginal delivery, 58.three% had Caesarian section, at the identical time as five% had instrumental delivery. about one 1/3 of participants (35%) had preterm deliveries, whilst 5% had placed up-term deliveries. determine 1 shows that maternal results (7.7%, 7.7%

,5%, 3.3% ,3.3% &1.7% ) had seizures ,cardiovascular headaches, HELLP syndrome ,abruption placentae, postpartum hemorrhage and renal complications respectively .however fatal effects suggests that ten toddlers (16.7%) were small for their gestational age, 35% had untimely shipping, five% had respiration distress syndrome, 3.three% had metabolic acidosis, and 3.3% had intrauterine increase retardation, even as one female had IUFD (1.7 %) and one had neonataldeath.

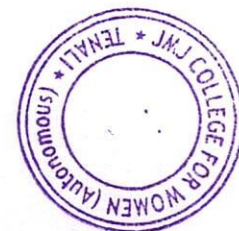
1. Assessment of complete history was now not completed through way of the nurse however by using the health practitioner

2. Deep tendon reflexes in step with situation modified into no longer finished by the nurse, however thru the medical health practitioner

**Table 1.** Distribution of pregnant women with gestational hypertension in relation to their demographic characteristics (n=60)

Studied sample		
Demographic characteristics		%
Age (in years)		
<30	28	46.7
- 30-35	22	36.7
- >35	10	16.7
Mean +SD	32.6+9.7 years	
Educational level		
- Illiterate	6	10.0
- Basic education	31	51.7
- University	23	38.3
Occupation		
- Housewife	41	68.3
- Student	6	10.0
- Employee	13	21.7

**Table 2.** Frequencydistribution of pregnant women with gestational hypertension in relation totheir obstetric history (N=60)



		Studied sample	
	No.	%	
Obstetric history			
Gravidity:		Primigravida (a)	
·			21 35.0
·	2-5		22 36.7
·	Mean +SD		17 28.3
			3.75 + 3.1975
	Min, max		1, 18
Parity:			
·	0		23 38.3
·	1-3		21 35.0
·		≥4	16 26.7
·		Mean +SD	3.594 + 2.242
		Min, max	1, 11
No. of abortions:			
·	0		39 65.0
·	1		12 20.0
·	>2		9 15.0
		Mean +SD	1.571 +0.926
		Min, max	1, 5

Table 3. Distribution of pregnant women with gestational hypertension in relation to clinical findings (n=60)

Clinical findings	Sample studied	
	No.	%
Category of gestational hypertension		
· Mild to moderate pre-eclampsia (1)	30	50.0
· Severe pre-eclampsia (2)	26	43.3
· Eclampsia (3)	4	6.7
Grades of Edema		
· <2 mm (+1 edema)	30	50.0
· 2-4 mm (+2 edema)	17	28.3
· 4-6 mm (+3 edema)	10	16.7
· 6-8 mm (+4 edema)	3	5.0

Table 4. Frequency distribution of pregnant women with gestational hypertension in relation to pregnancy outcomes (n=60)

Pregnancy Outcomes	Studied sample	
	No.	%
Mode of delivery		
- Spontaneous normal vaginal delivery	22	36.7
- Cesarean delivery	35	58.3
- Instrumental delivery	3	5.0
Timing of delivery		
- Pre-term (< 37 weeks)	21	35.0
- Full term (37- 41 weeks)	36	60.0
- Post-term (>41 weeks)	3	5.0



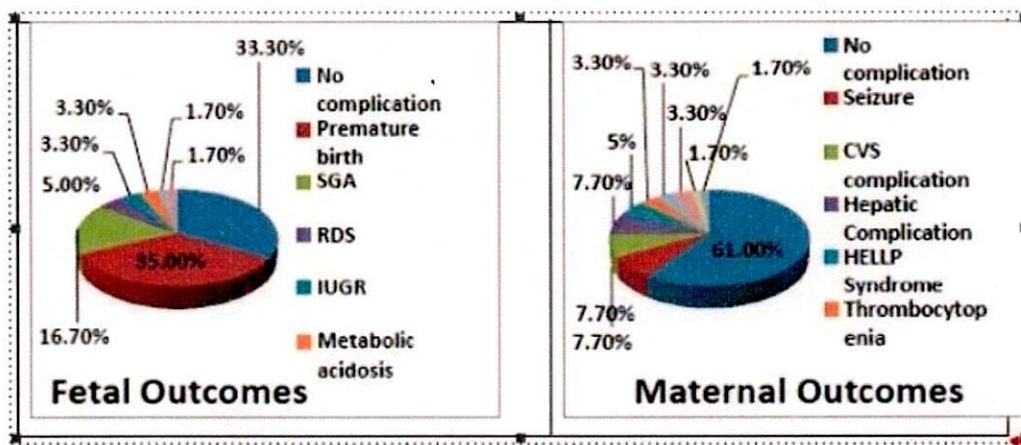


Figure 1. Frequency distribution of pregnant women with gestational hypertension in relation to maternal & fetal outcomes (n=60)

Table 5: indicates that the least clearly finished nursing care sports activities regarding initial evaluation of girls with mild to slight preeclampsia have been: each day weighing of the affected person (zero%); and to put the customer on her left facet for 20 minutes, then recheck BP once more along with her sitting up (26.7%). on the other hand, the brilliant finished nursing care sports activities had been checking a urine pattern for protein, monitoring fatal well-being, selling relaxation and relaxation and effectively administering medicines (90 3.3% for all). furthermore the least finished nursing care sports activities concerning manage of gestational hypertension and fitness training for girls with moderate to moderate preeclampsia modified into: encouraging a balanced (13.3%). alternatively, the executed nursing care changed into documenting all findings on the female's report (96.7%).

1. evaluation by using taking complete data changed into no longer accomplished by means of manner of the use of the nurse but with the beneficial useful resource of the medical health practitioner
2. Deep tendon reflexes turned into now not completed through the nurse however by using way of the medical doctor or nurses if there were easy order
3. Investigate pulmonary edema with the aid of auscultation the lung bases for rales accomplished by way of manner of the usage of medical physician. Assessment of girls's instructional needs and provision of fitness education changed into accomplished thru affected individual educator. table

6: indicates that the least executed furnished care concerning preliminary evaluation of girls with excessive preeclampsia changed into day by day weighing of the affected character (3.8%). however, the completely done supplied care were: monitoring fatal properly-being (fatal coronary coronary heart sounds and uterine contraction with the useful resource of CTG & non-pressure test); Fatal movement counting- maintaining track of fatal of kicks and movements; promoting rest and rest; administering medicinal tablets as prescribed and administration of magnesium sulfate (one hundred% for all). additionally, it suggests that the least done supplied care concerning manipulate of gestational high blood stress and fitness training for women with intense preeclampsia become: identifying problems/goals constant with nursing procedure (42.3%). as an alternative, the tremendous completed furnished care modified into encouraging girls to take a balanced weight loss plan(9 .3%). parent (2) indicates that furnished health care have become completed for loads a good deal much less than one 1/3 of player girls with gestational high blood stress (30%), on the identical time as furnished care became in part done for 32% of people.

However, provided health care was not achieved in 38% for cases. 1. Statistically significant ( $p < 0.05$ )

Table 5. Frequencydistribution of pregnant women with gestational hypertension or mild tomoderate preeclampsia in relation to the provided health care (n =30)



	Achieved	Partially achieved	Not Achieved
The provided health care			
The general assessment	96.7	3.3	0.0
Take a complete history (1)			
Perform a complete physical assessment& abdominal examination	96.7	3.3	0.0
Continuous monitoring the fetal heart sound and uterine contractions	93.3	6.7	0.0
Position the client , then recheck BP again	26.7	30.0	43.3
Count fetal movements and keep track of fetal kicks and movements	90.0	6.7	3.3
Weigh the woman daily	0.0	83.3	16.7
The specific care	90.0	6.7	3.3
Check the vital signs (T PR) and the BP q 4 hour			
Assess deep tendon reflex every 4 hour (2)	46.7	33.3	26.7
Assess the intake and output strictly	90.0	10.0	0.0
Check the urine sample for protein	93.3	6.7	0.0
Minimize external stimuli	83.3	16.7	0.0
Promote rest and relaxation	93.3	6.7	0.0
Administer fluid and electrolyte	100	0.0	0.0
Administer the prescribed medications	93.3	6.7	0.0
Document all findings	96.7	3.3	0.0
Identify women's problems/needs according to nursing process	60.0	20.0	20.0
Assess women's educational needs and provide health education according to the condition(1)	73.3	16.7	10.0
Encourage the client to take well balanced diet with moderate to high protein and low to moderate sodium (1)	13.3	23.3	63.3
Educate the client about fetal movement counting	90.0	10.0	0.0

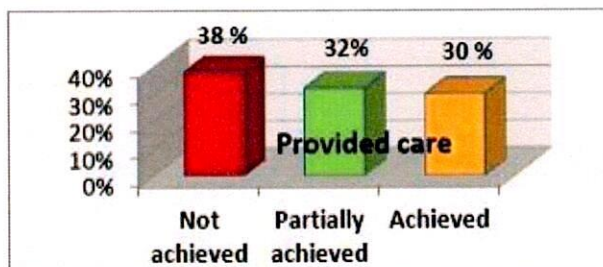


Figure 2. The achieved provided health care to participant women with gestational hypertension



The provided health care	Achieved	Partially	Not
	%	achieved %	Achieved %
The general assessment			
Take a complete history(1)	84.6	7.7	7.7
Perform a complete physical assessment and abdominal examination	84.6	7.7	7.7
Continuous monitoring the fetal heart sound and uterine contractions	100	0.0	0.0
Count fetal movements and keep track of fetal kicks and movement	100	0.0	0.0
Position the client, then recheck BP again	30.8	0.0	69.2
Weigh the woman daily	3.8	42.3	53.8
The specific care	23.1	15.4	61.5
Check the vital signs and the BP q 1 hour			
Assess deep tendon reflex hourly(2)	65.4	30.8	3.8
Assess (face , upper extremities and lower extremities ) edema	80.8	3.8	15.6
Assess pulmonary edema by auscultate the lung bases for rales (3)	100	0.0	0.0
Insert Indwelling urinary catheter & check the urine sample for protein	96.2	0.0	3.8
Assess the intake and output strictly	96.2	0.0	3.8
Minimize external stimuli	65.4	30.8	3.8
Promote rest and relaxation	100	0.0	0.0
Administer fluid and electrolyte	100	0.0	0.0
Administer the medication as prescribed	100	0.0	0.0
Document all findings on the woman's record	80.8	3.8	15.4
Identify women's problems/needs according to nursing process	42.3	15.4	42.3
Assess educational needs and provide health education according to women's condition	92.3	0.0	7.7
Encourage the client to take balanced diet with moderate to high protein and low to moderate sodium	50.0	38.5	11.5
Educate the client about fetal movement counting	80.8	3.8	15.4

Relationship between pregnancy outcome (maternal and fetal) of women with gestational hypertension and the pro are (n=60)

Pregnancy Outcome (n=23)	The Provided health care				Achieved		Value
	Not achieved		Partially achieved (n=19)		Achieved		
	No.	%	No.	%	No.	%	
Fetal outcome							
- Complicated	19	82.6	14	73.7	7	38.9	0.010*
- Non-complicated	4	17.4	5	26.3	11	61.1	
Maternal outcome:							
- Complicated	13	56.5	8	42.1	2	11.1	0.012*
- Non-complicated	10	43.5	11	57.9	16	88.9	



table 7 shows that fatal complications have been most at the same time as the supplied fitness care for women with gestational hypertension have become now not accomplished (eighty 2.6%), even as even as the furnished health care became completed; the fatal headaches have been less (38.9%). differences in proportions of fatal complications regular with the success of the provided health care have been statistically big ( $p=0.010$ ). in addition, maternal complications were maximum whilst the provided health contend with women with gestational high blood pressure grow to be not carried out (56.5%), at the same time as even as the provided fitness care modified into achieved; the maternal complicated cases were at a minimal(11.1%). Differences in proportions of maternal complications in step with the fulfilment of the furnished health care have been statistically vast( $p=0.012$ ).

#### Discussion:

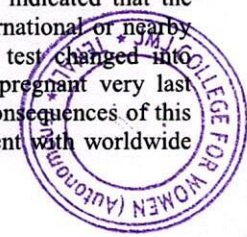
The give up result of the winning have a look at confirmed that half of the entire have a observe sample have been loads a great deal much less than thirty years antique and the advocate age become 32 years vintage, that have grow to be similar to Abalos et al.'s (2015) examine. Moreover, a couple of 0.33 of participants were primigravidas. furthermore, approximately 1/2 of them had a easy university education, on the identical time due to the fact the remainders have been illiterates. more than thirds of humans have been housewives (1). a number of the ones developments constitute diagnosed danger elements for being pregnant added about hypertension. The factors that boom hazard encompass primiparity, specifically at a more youthful age, and multiparity, specially at an older age (over 35 years) (14). those findings concur with those suggested through numerous researchers. Hafez & Sayed, (2014) stated that women's socioeconomic situation is a danger scenario that contributes to a better occurrence of gestational excessive blood strain, as its prices are tons better in horrible and developing worldwide places, in which maximum pregnant ladies have an incomplete number one or secondary academic degree (15). additionally, most had been housewives or had jobs as maids or clerks. furthermore, girls with low academic degrees normally have a better hazard of gestational high blood strain (16). nearly approximately being pregnant consequences, it have turn out to be located that approximately one 1/3 of the ladies underwent spontaneous everyday vaginal transport; extra than 1/2 of them had caesarian sections, at the same time as 5% had instrumental deliveries. ladies with high blood pressure during being pregnant might be prone to life threatening results and in such instances a caesarean phase should be finished to guard each little one and mother (1) be the principle reason of increased sort of caesarean sections most of the girls in the current observe. approximately one 1/3 of individuals had preterm deliveries, at the same time as 5% had positioned up-time period deliveries. considerably, the maternal final results on this check recorded no maternal deaths; however, the diverse taking element ladies 38.three% had immoderate complications which incorporates hepatic complications, seizures, postpartum hemorrhage, HELLP syndrome, thrombocytopenia, DIC and renal headaches. moreover the maternal complications of preeclampsia include loss of life, intense morbidity (along side pulmonary edema, renal failure, coagulopathy, cardiac failure, liver failure, and stroke), HELLP syndrome, placental abruption, and caesarean section (18) (19) (20). but, the outcomes showed that 66.7% of the neonates in the have a check had been complex. 35% of the infants had premature shipping, 16.7% were small for gestational age, 5 % had respiration misery syndrome, 3.3% had metabolic acidosis, and 3.3% had intrauterine growth retardation; one toddler modified into intra uterine fatal lack of existence (IUFD) and there has been one neonatal loss of lifestyles after neonatal widespread care unit (NICU) admission. Various studies were actually supported with the neonatal complications inside the modern-day have a take a look at, which incorporates mortality, intrauterine increase restrict, prematurity, and excessive morbidity (which includes intra-ventricular hemorrhage, immoderate respiration misery syndrome, or asphyxia (5) (19). The excessive rate of premature starting has been suggested with the aid of Sajith, M., Nimbargi, V., Modi, A., &Sumariya, R. (2014), who defined that immoderate preeclampsia is characterised with the useful resource of the use of present day deterioration in each maternal and fatal conditions and that the charge became of prematurity that is just like the contemporary-day have a have a test (20). furthermore, the absence of mortality rate within the present have a look at is at par with have a look at of Abalos et al., (2015)(1). In assessment, the mortality of fetus' and neonates in this have a look at had been gift that is at par with the have a have a have a have a look at of Kattah and Garovic (2013)(2) This study found out that correct sufficient care changed into supplied for a great deal much less than one zero.33 of the ladies with gestational high blood stress (30%), even as it have grow to be partially furnished for 32% of the girls; but, proper care modified into now not carried out in 38% of times. it's far been stated that numerous nursing care sports activities were each now not executed or not fully finished for contributors with mild to mild or immoderate pre-eclampsia. concerning ladies with mild to moderate preeclampsia, the least completely finished nursing care sports in phrases of initial evaluation were each day weighing of the affected individual and to place the client on her left detail for 20 mins, then to recheck the blood pressure all over again together with her sitting up. The maximum done nursing care sports have been checking urine for protein, monitoring fatal properly being, selling rest and rest and efficaciously administering drug remedies. The nurses want to show all ladies with gestational immoderate blood strain (21). The intention of monitoring ladies with mild gestational excessive blood strain is to examine, and encounter early, the development of the circumstance to extreme preeclampsia. In sufferers with mild preeclampsia, the



purpose is early detection of immoderate preeclampsia, at the equal time as for humans with severe preeclampsia; the cause is to test for the improvement of organ disorder. consequently, nurses have to examine all such instances for symptoms and symptoms of organ illness, e.g., excessive complications, visible changes, altered mental recognition, right higher quadrant or epigastric ache, nausea or vomiting, shortness of breath, or decreased urine output. with reference to women with intense preeclampsia, the least completed nursing care hobby concerning initial evaluation have become every day weighing of the female. The genuinely completed nursing care sports activities sports had been: monitoring fatal fitness (fatal coronary heart sounds and uterine contraction by using the use of manner of CTG & non-stress take a look at); fatal motion counting- retaining song of fatal kicks and actions; selling relaxation and relaxation; administering medicinal tablets as prescribed and of magnesium sulfate. Maembe,(2012) stated that, because of the fact the reason of pre-eclampsia is uncertain, nursing manipulate is important. A nursing care plan for girls with being pregnant brought about excessive blood stress includes tracking essential signs, weight, urine output and degree of interest, assessing deep tendon reflexes and symptoms and symptoms and signs of headache or epigastric pain, further to imparting treatment as prescribed. The nursing care plan consists of allowing the affected man or woman complete mattress rest, selling rest and relaxation, and assessing her emotional and psychological needs. Complete or partial bed rest for the duration of pregnancy is often recommended (22). On the other hand, results of this study revealed that almost all activities for the initial nursing assessment of eclamptic women, management of convulsion attacks, and identification of problems/needs were performed. The researcher believes that most of the care for eclampsia cases was performed thoroughly because the nurses in the emergency department were providing these essential aspects of care as urgent life savingmeasures. Results of this study clearly indicated that both fatal and maternal complications were highest when nursing care was not adequate, while when the nursing care was delivered appropriately, the number of fatal and maternal complications were at a minimum. However, important findings indicated that the care provided to the gestational hypertensive women was not totally in line with international or regional guidelines of management of gestational hypertension. In accordance with findings of the present study, the crucial role played by nurses for management of women with pre-eclampsia /eclampsia has been emphasized by Bell, (2011) who stated that, effective preventive measures and screening tools are mostly lacking in cases of gestational hypertension and that routine nursing assessments of the signs/symptoms indicative of preeclampsia-eclampsia remains critical to detection, monitoring, and effective management. Patient education and the provision of a supportive environment are essential factors in nursing management of these cases (23). Daniels (2011) argued that many researchers have debated the causes of adverse birth outcomes (low birth weight, preterm births, and infant mortality) (24). The most recent recommendations are that pregnant women should obtain antenatal care in the first trimester and throughout the duration of their pregnancy, especially those at greater risk for these adverse birth outcomes (25). Moreover, Prost et al., (2013) found that antenatal care visits during the third trimester were significantly lower among preeclampsia/eclampsia cases than among controls(26). This study's results revealed that nurses do not practice some aspects of the American Protocol for Gestational Hypertension Management. Firstly, to obtain the history, the nurse should follow the history assessment section on the nursing admission sheet and the physician should obtain a complete history. Secondly, nurses are not assessing the deep tendon reflexes and pulmonary edema unless there is a clear doctors order in one of the study's hospitals, and they are not doing at all in the second hospital despite these two items being critical signs of a gestational hypertensive woman's deterioration. It was performed by the physician but either was not performed completely or regularly by the nurse and depended upon the physician's assessment. Thirdly, the women's weight was not measured daily; the nurses took the weight during admission once or depended on the weight at the last visit to the clinic. Fourthly, identifying the problems and needs of the women are not performed in one of the study's hospitals and the nurses in the other hospital write a nursing care plan and prepared an inpatient file but not all the planned care is implemented effectively, which is crucial nursing action for discovery, management and prevention in high risk cases. Fifthly, not all nurses provide education to patients. This was performed either by physicians or a patient educator, but from a nursing perspective these points are considered part of a nurses' role as they are present with patients 24 hours per day while the educators are not. According to current study there was an obvious omission in this aspect of nursing care.

#### CONCLUSION

The triumphing have a look at concluded that both lethal and maternal headaches had been maximum even as nursing care have become now not completed, whilst even as the nursing care come to be executed; the deadly and maternal complicated instances were at a minimum. but, the take a look at findings indicated that the supplied care to the gestational hypertensive girls became now not simply steady with international or nearby suggestions of gestational excessive blood pressure control. The research query of this test changed into answered through the consequences that proved the effective relation among the being pregnant very last consequences and the nursing care provided amongst gestational hypertensive ladies. The consequences of this have a take a look at advocated that increase an extraordinary protocol for nursing consistent with worldwide



tips for instances of gestational excessive blood strain to standardize the care provided in outpatient and inpatient departments and shipping unit and the software program of nursing exercise based on evidence also have a take a look at truly shows the want to prepare continuing nursing education and education workshop for all of the nurses and innovate a easy protocol in dealing with gestational excessive blood pressure woman.

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## **Micro Credit Borrowers In Srimushnam Taluk - An Overview**

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### **ABSTRACT**

Micro Credit is defined as a process of meeting the capital requirements of individuals and groups for the startup and sustenance of small business enterprises. This study is confined to the Micro Credit in Srimushnam Taluk. Urban Micro Finance beneficiaries from each group were chosen as the sample respondents. Information's relating to the operations of micro credit at the group level has been discussed with a schedule exclusively prepared for these purpose. Present study is mainly based on responses given by the beneficiaries on the micro credit scheme. This study is an attempt to examine the impact of Micro Credit on the development of agriculturist, fisheries and women in Srimushnam Taluk and also measure the levels of satisfaction on micro finance. This empirical basis of the study would help to suggest the ways and means for accelerating the growth of micro enterprises through micro groups. Conclusion will be given.

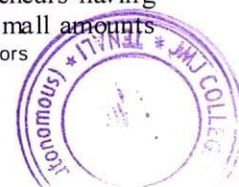
**KEY WORDS:** Impact of micro credit, Level of satisfaction, Micro credit, Micro finance.

### **1. INTRODUCTION**

Microfinance is a banking service provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services. It allows people to take on reasonable small business loans safely, and in a manner that is consistent with ethical lending practices. Microcredit is a common form of microfinance that involves an extremely small loan given to an individual to help them become self-employed or grow a small business. These borrowers tend to be low-income individuals, especially from less developed countries (LDCs). Microcredit is also known as "microlending" or "micro loan."

Finance is one of the most crucial inputs for economic activity, growth and development. If finance through own accumulated resource or equity is neither available nor sufficient, debt assumes a major significance. The structure of rural financial market in India is dualistic: both formal and informal financial intermediaries operate. The rural borrower has been depending upon institutional sources for production/investment credit requirement. But, for consumption credit needs, she/he is forced to go to non-institutional sources. However, credit provided by non-institutional/informal lenders has been exploitative and expensive for rural poor. In rural areas women living below the poverty line are unable to realize their potential. Microfinance programmes are currently being promoted as a key strategy for simultaneously addressing both poverty alleviation and women's empowerment. Microfinance is only a means and not an end. The ultimate goal is to reduce poverty.

A Self Help Groups (SHGs) is a registered or unregistered group of micro entrepreneurs having homogeneous social and economic back ground, voluntarily coming together to save small amounts



regularly, to mutually agree to contribute to a common fund and to meet their emergency needs on mutual help basis. The group members use collective wisdom and peer pressure to ensure proper end-use of credit and timely repayment thereof. In fact, peer pressure has been recognized as an effective substitute for collaterals. SHG can be well defined "as a self-governed, peer-controlled, informal group- of people, who share similar socio-economic status, and have a desire (need) to collectively perform in order to meet their individual needs primarily through resorting to small amounts of saving (thrift) and by using group loans for meeting their emerging credit needs.

### **MICRO CREDIT IN INDIA**

The Self Help Groups (SHGs) emerged as a component of the Indian Financial System after 1996. They are small, informal and homogenous groups of not more than 20 members each. The size of 20 has been made mandatory because any group larger than this has to be registered under the Indian Societies Registration Act. Also, the repayment rate tends to be lower in large groups as the magnitude of the free rider problem and the propensities to default are high in heterogeneous groups. The present availability of credit for women in India is from the following sources: Three fourth of the Formal Credit Structure which represents banks, co-operatives, Regional Rural banks and other financial institutions like NABARD, SIDBI (through NGOs), etc. Three fourth of the Quasi informal which represent linkage between banks and Self Help Groups, providing bulk financing for NGOs for lending to set up of a National Credit Fund for women by Government of India (Rashtria Mahila Kosh). There is a vast network of banking and cooperative finance institution in India and therefore formal financial services are in theory available and accessible to low income families in virtually every part of the economy. There are three broad approaches employed for providing financial services to the poor all of which focus on women.

### **PROMOTING MICRO-CREDIT FINANCE AND SELF HELP GROUP – BASED FINANCING**

Micro-credit and self-help group financing policy and programs are characterized both by the mechanisms they use to reduce risk and by the population group they target. Some of the more common features of the micro-credit programs and policies are the following

- Loan amount: Micro-credit loans tend to be very small .The actual amount arise substantially from country to country.
- Short term working capital: Micro-credit cycles vary between a few weeks to a few years (typically three to four years)
- Repayment schedules: Micro-credit loans are characterised by small, frequent repayment schedules ranging from weekly repayments to monthly or yearly. This allows the borrower to pay down the loan in small amounts and gives him the capacity to manage his finances better without being over burdened by debt repayment.
- Social collateral: the Self Help Group is the fundamental unit of most Micro Credit finance policies. By forming small groups whose members are jointly liable for each individual's loan, Micro Credit policy creates a form of social collateral to substitute for material asset.
- Interest rates: Micro-credit loans charge interest rates that are higher than the commercial rate. Charging interest rates that cover the full cost of the loan serves: to maintain fund levels.



- Gender focus: Micro-credit policies focus on women

**STATEMENT OF THE PROBLEM**

The credit needs of micro enterprises, for meeting their day-to-day operation are different from conventional types of lending. The credit needs of micro enterprises are small and frequent in nature. While servicing the micro enterprises the timeliness of credit and the financial institutions are crucial. Any financial product and package for micro enterprises necessarily have to meet objectives of both the lender and the borrowers.

The linkage between “self help groups” and banks has been highly successful in furthering Micro credit. The cooperation between the formal banking system and micro-finance organizations has also been encouraging. Micro finance (MF) in the recent past has emerged as a potential instrument for poverty alleviation and women empowerment. MF intervention refers to provision of access to small loans without physical collateral to the poor, especially the women, while encouraging them to save regularly in order to combine thrift and self-help for their own development.

**2. OBJECTIVES OF THE STUDY**

The objectives are to identify the economic impact of Micro Credit to Borrowers and to measure the Levels of Satisfaction on Micro Finance.

**3. METHODOLOGY**

Both Primary and Secondary data were used for the study; Secondary data pertaining to the study were gathered from the annual reports, Government banking journals, books, etc. as for as banks are concerned, the borrowers of micro finance was selected by following convenience sampling method. The primary data were collected from 150 sample respondents with the help of interview schedule.

**AGE OF THE RESPONDENTS**

Age	No. of Respondents	Percentage
Below 25	16	10.67
26-35	73	48.66
36-45	51	34.00
Above 45	10	6.67
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLENO. 1**



From the above table reveals that the age of the respondents. It is clearly stated that the 48.66% of the respondents belongs to the age group of 26-35, 34% of the respondents belongs to 36-45, 10.67% of the respondents belongs to below 25 and rest of the respondents are belongs to above 45. Hence, the majority of the respondents are in the age group of 26-35.

**EDUCATIONAL QUALIFICATION OF THE RESPONDENTS**

<b>Educational Qualification</b>	<b>No. of Respondents</b>	<b>Percentage</b>
Illiterate	04	2.67
Primary	43	28.67
High School	68	45.33
Diploma	24	16.00
Others(degree)	11	7.33
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 2**

From the above table shows that Educational Qualification of the respondents. It is clearly stated that the 45.33% of the respondents are have high school education, 28.67% of the respondents are have primary education, 16%, 7.33%and 2.67% of the respondents are have diploma, others and illiterate respectively. Therefore, the majority of the respondents are had high school education.

**MARITAL STATUS OF THE RESPONDENTS**

<b>Marital Status</b>	<b>No. of Respondents</b>	<b>Percentage</b>
Unmarried	28	18.67
Married	103	68.67
Widowed	12	8.00
Divorced	07	4.66
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 3**

From the above table shows that Marital Status of the Respondents. 103 respondents are married, 28 respondents are unmarried, 12 respondents are widowed and 7 respondents are divorced. So, it is concluded that the majority of the respondents are married.

**TABLE NO. 4: DAILY INCOME OF THE RESPONDENTS**

<b>Daily Income</b>	<b>No. of Respondents</b>	<b>Percentage</b>
Below 500	49	32.67

501-750	78	52.00
751-1000	17	11.33
1000 Above	06	4.00
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 4**

From the above table explained that daily income of the Respondents. 52% of the respondents are belongs to daily income of Rs.501-750, 32.67% of the respondents are belongs to daily income of Rs. below 500 and 11.33% and 4% of the respondents are belongs to daily income of Rs.751-1000 and above 1000. So, it is concluded that the majority of the respondents are earned Rs. 501-750 per day.

**TYPE OF HOUSE OWNED OF THE RESPONDENTS**

Type of House Owned	No. of Respondents	Percentage
Pucca House with Electricity	91	60.67
Tile-shed and Electrified	38	25.33
Kutchra floor with electricity	13	8.67
No house	08	5.33
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 5**

From the above table reveals that Type of House owned of the Respondents. 60.67% of the respondents are owned Pucca House with Electricity, 25.33% of the respondents are owned Tile-shed and Electrified, 8.67% of the respondents are owned Kutchra floor with Electricity and 5.33% of the respondents are not owned house. So, it is concluded that the majority of the respondents are owned Pucca House with Electricity.

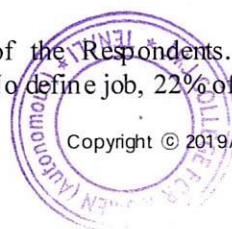
**OCCUPATIONAL STATUS OF THE RESPONDENTS**

Occupational Status	No. of Respondents	Percentage
Agriculture	43	28.67
Fishery	10	6.67
Self employed	33	22.00
No define job	41	27.33
Salaried People	23	15.33
<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 6**

From the above table reveals that Occupational Status of the Respondents. 28.67% of the respondents are Agriculture, 27.33% of the respondents are No define job, 22% of the respondents



are Self employed and 15.33% of the respondents are Salaried People So, it is concluded that the majority of the respondents are Agriculture.

**SOURCE OF INFORMATION ABOUT THE SCHEME**

S.No.	Source of Information	No. of Respondents	Percentage (%)
1.	Bank officials	96	64.0
2.	Micro groups	14	9.3
3.	Co-beneficiaries	27	18.0
4.	Others	13	8.7
	<b>Total</b>	<b>150</b>	<b>100.00</b>

Source: Primary Data

**TABLE NO. 7**

From the above table reveals that Source of Information about the Scheme. 64% of the respondents know information through bank officials, 18% of the respondents know information through Co-beneficiaries. So, it is clearly stated that the majority of the respondents are getting information through bank officials

**REASONS FOR THE PREFERENCE OF MICRO CREDIT SCHEME**

S.No.	Reason	No. of Respondents	Percentage
1.	To increase income and saving	12	8.0
2.	To avoid money lenders	48	32.0
3.	To earn stable Income	12	8.0
4.	To be independent and self reliant	9	6.0
5.	To reduce family burden	27	18.0
6.	To meet urgent needs	42	28.0
	<b>Total</b>	<b>150</b>	<b>100.0</b>

Source: Primary Data

**TABLE NO. 8**

The above table reveals the reasons why women vendors prefer borrowing under the micro credit scheme. There are number of reasons for women preferring micro credit. 8% of the respondents stated that they borrowed from micro credit scheme in order to increase income and savings. 32% of the respondents expressed that in order to avoid money lenders, 28% of respondents stated that they borrowed from micro credit finance scheme in order to meet urgent needs, though some of the respondents also expressed that it would be helpful to earn income and stand independent and self reliant. However 18.0 per cent of the respondents borrowed self-help credit mainly due to the family burden. Anyhow this scheme will create savings habit and income generation among the poor women and it saves the women from the harassment of the local money lenders.

**ECONOMIC IMPACT OF MICRO CREDIT**

S.No.	Particulars	Number of Respondents (%)		Total
		Yes	No	



1.	Micro credit helps to create better employment opportunities to the women vendors	135 (90)	15 (10)	<b>150</b>
2.	Micro credit promotes Entrepreneurship	132 (88)	18 (12)	<b>150</b>
3.	Micro credit helps in increasing Income	138 (92)	12 (8)	<b>150</b>
4.	Micro credit helps in increasing Production/business	126 (84)	24 (16.0)	<b>150</b>
5.	Micro credit helps in improving the economic condition of the respondents	148 (98.67)	2 (1.33)	<b>150</b>
6.	Micro credit helps to uplift standard of living conditions of the women vendors.	141 (94.0)	9 (6.0)	<b>150</b>

Source: Primary Data

**TABLE NO 9**

The survey inquired about the economic impact of micro credit. According to 90 per cent of respondents micro credit helps them to create better employment opportunities to the women vendors, 94 per cent of respondents stated that micro credit helps to improve their standard of living. For 88% of respondents feels micro credit promoted women entrepreneurship. The view of 84 per cent of respondents was that micro credit helps in increasing production/ business. Micro credit helps in improving the economic conditions of respondents was revealed by 98.67 % of the respondents. While according to 92.0 per cent of respondents micro credit helps in increasing income.

**POSITION OF RESPONDENTS AFTER AVAILING MICRO CREDIT**

S.No.	Particulars	No. of Respondents	Percentage
1.	Increased	145	96.67
2.	Not increased	5	3.33
	<b>Total</b>	<b>150</b>	<b>100.0</b>

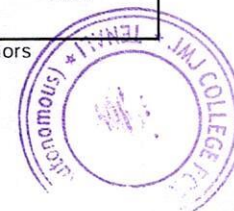
Source: Primary Data

**TABLE NO 10**

Table reveals that the sales turnover position of sample respondents 96.67 per cent of the respondents had increased the sales turnover and 3.33 per cent of the respondents are not increased.

**PROBLEMS OF MICRO CREDIT BORROWERS**

S.No.	Particulars	Number of Respondents %		Total
		Yes	No	
1.	Competition from better quality production	126 (84.0)	24 (16.0)	<b>150</b>
2.	Low price and low profit	113 (75.3)	37 (24.7)	<b>150</b>
3.	Marketing problems	131 (87.3)	19 (12.7)	<b>150</b>
4.	Lack of transportation	111 (74.0)	39 (26.0)	<b>150</b>



Source: Primary Data

**TABLE II**

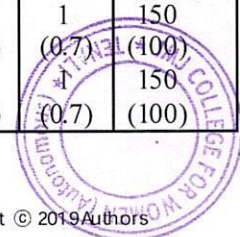
Table shows the problems of micro credit borrowers, 84.0 per cent of the respondents faced the Competition from better quality production, 75.3 per cent of respondents faced the and Low price and low profit, 87.3 per cent of the respondents faced marketing problems and 74.0 per cent of the respondents faced transportation problem.

**OPINION OF RESPONDENTS TOWARDS FACTORS INFLUENCING LEVELS OF SATISFACTION ON MICRO FINANCE**

S.No	Particulars	HS	S	UD	DS	HDS	Total
1	Mode of finance	14 (9.3)	23 (15.3)	12 (8.0)	78 (52.0)	23 (15.3)	150 (100)
2	Amount of financial assistance	21 (14.0)	38 (25.3)	79 (52.7)	8 (5.3)	4 (2.7)	150 (100)
3	Attending to complaints	14 (9.3)	19 (12.7)	67 (44.7)	5 (3.3)	45 (20.0)	150 (100)
4	Availability of banks	21 (14.0)	22 (14.7)	75 (50.0)	9 (6.0)	23 (15.3)	150 (100)
5	Interest rate	13 (8.7)	22 (14.6)	107 (71.3)	4 (2.7)	7 (4.7)	150 (100)
6	Repayment period	16 (10.7)	21 (14.0)	70 (46.7)	6 (4.0)	1 (0.6)	150 (100)
7	Approach of bank staff	13 (8.7)	59 (39.3)	71 (47.3)	6 (4.0)	1 (0.7)	150 (100)
8	EMI (repayment amount)	53 (35.3)	72 (48.0)	20 (13.3)	4 (2.7)	1 (0.7)	150 (100)
9	Terms and conditions	37 (24.7)	32 (21.3)	74 (49.3)	6 (4.0)	1 (0.7)	150 (100)

Source: Primary Data

**TABLENO 12**



**LEVELS OF SATISFACTION INDEX**

S.No	Factors	Mean scores	Assigned rank
1	Mode of finance	377	9
2	Amount of financial Assistance	514	4
3	Attending to complaints	402	7
4	Availability of banks	459	6
5	Interest rate	489	5
6	Repayment period	387	8
7	Approach of bank staff	527	3
8	EMI (repayment amount)	622	1
9	Terms and conditions	548	2

Source: Compiled from data of Table 12.

**TABLE NO 13**

Most favorable attitude	-	5 x 150 = 750
Neutral attitude	-	3 x 150 = 450
Most unfavorable attitude	-	1 x 150 = 150

**4. CONCLUSION**

Srimushnam Taluk is one of the new Taluk of Cuddalore District with strong agricultural and allied agricultural activities. Commercial banks are one of the top most commercial banking sector which gives huge amount of micro finance to the beneficiaries. This bank is one of the earliest banks to introduce the Micro Credit Scheme. The research work reveals that the poor are bankable. The groups can really become agents to fight globalization using micro-finance where Gandhiji's dream of whatever can be made locally realized. However, SHGs and micro credit cannot be considered as a panacea for all the ills of the rural society. Micro finance should be viewed as complementary to the provision of basic services like education, housing, health and nutrition the latter are indispensable is the fight against poverty. The recovery performance is quite admirable. The repayment was very convenient to the respondents also, as recovery is made in weekly and monthly basis. The non-repayment was very low compared to regular agricultural loans. It can be inferred that this scheme has proved to be successful to the borrowers and recovery also good. Opportunities for assured and remunerative marketing, skill upgradation and technological training and promoting business counseling centers of the grass root level determine the success of micro credit supported micro enterprises now being advocated to end poverty.

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**Innovative Methods In English Language Teaching For  
Non-Native Speakers**

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**Abstract**

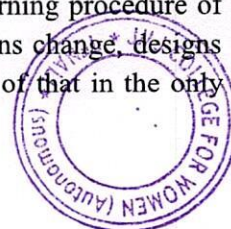
*Though English Language Teaching (ELT) seems to be simple and nothing more than just sending and receiving information, there are a variety of significant aspects underlying in this process. In the process of teaching, every teacher tries to understand the content in detail and prepares his best to pass on matter to the learners in the way he has comprehended. Therefore to be effective and successful in fulfilling this noble task, every teacher should be well aware of various innovative trends and techniques which have been emerged in the field of English teaching and how they will in turn be very useful and helpful to transfer the matter effectively into the young minds of learners. As a matter of fact the effective usage of the innovative methods in educational institutions will not only pave the way to the improvement in the quantum of education but also affect the quality in drawing outcome in a better way than the previous method used and subsequently leading to human development in a global manner. Keeping in view of this significant aspect, this paper intends to present the famous trends in the ELT that have been used practically in recent times in the entire world with specific reference to the trends prevalent during the previous decades.*

**Keywords:** *Methods, New devices, teaching and learning process, effectiveness of interfacing in learning*

**Introduction**

The development that the researcher talks in the paper certain both to methodology and materials utilized in language instructing. In addition, this article draws out the inconspicuous qualification between the academic view of language as treated in research and teaching method. The contention progresses as the paper continues with patterns of instruction with explicit reference to the Indian situation, techniques embraced, the former strategies, the peer practice, the present pattern, new showing plan, new gadgets, the requirement for change, the ICT and English language. English language instructing has experienced enormous changes throughout the years, particularly the most recent ten years.

In the present scenario, a large number of the students are feeling the weight of examining, learning and getting a handle on the materials, and obviously, addresses with the various accumulations of related data from recommended writings. Many vocation choices once respected insignificant are picking up noteworthiness at present, for example, relational abilities, delicate aptitudes, specialized aptitudes, relational aptitudes, ICT proficiency and so on. Thusly to fill the need, an adjustment in the pattern particularly the encouraging learning procedure of English language needs to experience a progress for the improvement. Seasons change, designs changes, dispositions of people change however it is unsettling to take note of that in the only

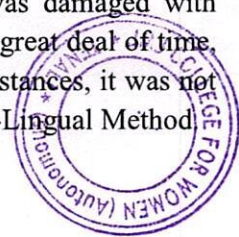


remaining century English educational program has barely experienced any change. There had been a lot of changes in the mentality of individuals with respect to what they see to be a language. Inflexible educational plans and gigantic prospectuses keep on compromising understudies who talk local vernacular yet love to exceed expectations in English.

The historical backdrop of unknown dialect has consistently been a significant functional concern. It was Latin which overwhelms different fields like instruction, business, religion and government in the western world. In sixteenth Century French, Italian and English accomplish part of significance as aftereffect of political changes in Europe. The investigation of traditional Latin and examination of its syntax turns into the model from Foreign Languages study from seventeenth to nineteenth century. In 21st Century we are going to train open language instructing. As indicated by Kripa K Gautam, "English Language Teaching" - A basic investigation of strategies and methodologies have given record of history of language educating techniques.

### **Approaches Adapted in Earlier days**

Communication is the foundation dependent on which any thought can advance and form into a completely fledged one. Without that, sustenance in any field is incomprehensible. During the most recent decade, different essential components have joined to influence the present belief systems of instructing of English, for example, the ineffectual approaches, inadmissible materials, and coordination of contextualized educating, over accentuation on multi language abilities and so forth. Instructors who rehearsed Grammar Translation strategy during the earlier decade exclusively depended on writing board as the well-suited device to give relational abilities and the subtleties of English language. Later on, over head projectors went about as another vehicle for the educator commanded study hall. Such educators trusted in the proclamation of drill and practice. Scientists had given more accentuation on valid and important contextualized talk. At that point they concentrated on fruitful grown-up second language learning as a parallel procedure to a youngster's first language obtaining. With the appearance of e correspondence, it has been made feasible for the English language educators to advance their calling. Essentially, the instructor controls the instructional procedure, the substance is conveyed to the whole class and the educator will in general stress true information. As it were, the educators convey the talk content and the understudies tune in to the talk. In this manner, the learning mode patterns to be latent and the students have little influence in their learning procedure. It has been found in many colleges by numerous instructors and understudies that the ordinary talk approach in study hall is of constrained adequacy in both educating and learning. This technique had remained by and by for a decent timeframe because of its emphasis on the useful utilization of English. Be that as it may, at present this strategy was damaged with misfortunes like there were numerous issues with this technique. It required a great deal of time, great spending plan and a little class size. Furthermore, even in certain circumstances, it was not extremely helpful. These issues prompted another Method that is called Audio-Lingual Method.



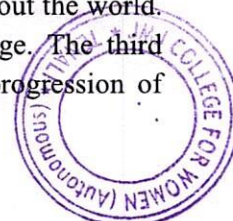
The immediate technique is common strategy for training unknown dialect which utilizes Audio-Visual Aids. The immediate strategy began in France in 1801. The immediate technique creates as a response against GTM. It's essential standard is that students should think straightforwardly in unknown dialect. DM is to show language straightforwardly at plans to make direct bond between the word and significance, thought and articulation. It's additionally improving the student's articulation.

In 21st Century there is ascent of open procedure. Which underline genuine significance specialized strategy than action, point and circumstances which are fake and remote from student's falsehoods.

### **Innovative Trends of Teaching English**

The procedure of English correspondence learning will be more focused yet less tedious. Accordingly, it guarantees that the instructing quality will be improved and learners' connected English correspondence can be adequately developed, implying that their open capability will be additionally created. Language in instruction would in a perfect world and customarily expand on such normally obtained language capacity, enhancing it through the advancement of education into an instrument for theoretical idea and the securing of scholarly learning. Educators utilize a scope of nearby messages or English interpretation of writing in the study hall. The utilization of language just as the utilization of an assortment of accents in listening exercises or tests is supported in the English language study hall. With the expansion of tablets and advanced mobile phones, it is accepted that course readings will vanish in a couple of years. Besides, the entrance to information as far as adaptability and versatility has changed radically. Educating in English language classes centers around cultivating the understudies thinking just as language substance, results and learning exercises. There are critical and complex understudy instructor communications inside and outside the homeroom. In an information based society and to stay aggressive and employable, instructors are relied upon to take part in a constant expert advancement or the expert taking in exercises from the earliest starting point to the part of the arrangement. Similarly as with some other calling, educators are additionally expected to accept a more prominent accountability for their own proficient adapting, constantly building up their insight and aptitudes.

Having understood the need of great importance: the English educators assemble various kinds of meetings and workshops to make a stage and to become acquainted with the forthcoming philosophies in the ELT and furthermore to update themselves expertly. It is the fifth aptitudes of language that empowers the productivity to utilize syntactic structures with exactness. Scholastic capability alone may not assist instructors with growing expertly, then again, they should be outfitted themselves with the present practices. The instructing materials that are being utilized in our nation are nearly made accessible everywhere throughout the world. There had been such a large number of techniques of showing English language. The third component of globalization which is indivisible from English instructing is a progression of



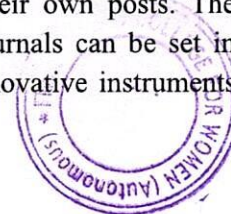
Information and Communication Technology. New patterns in English language training like intuitive methodology of encouraging English is created because of the continuation in the examination by the focal leading group of auxiliary instruction (CBSE New Delhi). This methodology likewise prescribed by the Indian Council of School Education (ICSE New Delhi).

The interface intends to impart the information which each other during association. Its methods give the data, considerations obscure to beneficiary. "Interfacing Approach it identified with the real utilization of language". So intelligent encouraging styles are Brain Storming, Think pair and offer, Buzz session, occurrence procedure, Q and A session. In Interactive methodology a few thoughts are pursue the pioneer, Total Physical Response (TPR), One word, Opposite Arguments, Test Tournaments, YouTube Videos Quizzes, Electronic Role Playing, Puzzle pieces. Open language instructing stresses on the procedure of correspondence as opposed to the dominance of language. Some time the term practical methodology is use for open methodology or informative strategy. Informative methodology dependent on the idea of 'open fitness' which initially presented HD Hymns an article on open skill distributed in, "New inceptions in Linguistics' in 1971.

The open methodology underlines genuine significant correspondence as opposed to the action, point and circumstance which are counterfeit and remote from understudy's lives. As indicated by Geeta Nagraj, "The Development of Language Learning ison the based methodology used in instruction". Open methodology has three steps 1. Which include genuine correspondence 2. Which includes different exercises. 3. Which accentuate that language is important to the students Web Based Learning.

Web based learning is one of the quickest creating zones. There are a large number of English electronic classes that offer trainings for an assortment of fundamental language aptitudes, for example, Learning, Speaking, Reading and Writing and are made intelligent in an assortment of ways. A portion of the regular innovations an accessible for advancement of instruction is as per the following: The researcher can relate with local speakers of the objective language utilizing an email by making an individual email account (g-mail, yahoo, hotmail, and so on) which is free.

The understudies can mail their home work to the educators concerned and get it redressed thus. The educator can likewise give modifications, criticism, recommendations for the advancement of each work and send them back. A blog is an individual or expert diary oftentimes refreshed for open utilization. The online journals empower transferring and connecting the records which is especially fit to fill in as on line individual diaries for understudies. Blogging ends up informative and intuitive when members expect different jobs in the composition procedure, as commentators who react to other author's posts, and as journalists' peruses who, coming back to their own posts, respond to analysis of their own posts. The perusers thus can remark on what they read, despite the fact that web journals can be set in verified conditions also. Each network access has sound capacities and innovative instruments





like workstations with cameras. The understudies could speak with their instructors and companions who are far away. In like manner, they could speak with the speakers of local language and get their articulation checked to improve their talking. Students can look for new words utilizing lexicon alternative in the cell phones and advance their jargon. They may confirm the spelling elocutions and use of the particular word they scanned for. Besides, they can utilize Short Message Service (SMS) to send questions to their educators and get their questions cleared. iPods', one of the interactive media gadgets, improve to clients to create, convey, trade writings, picture, sound and video contents according to the prerequisite. The instructors send instant messages and the understudies can read and answer to them.

Suggestopedia is an encouraging strategy created by the Bulgarian psychotherapist Dr. Georgi Lozenov. Suggestopedia has been known as a pseudoscience. It unequivocally relies upon the trust that understudies create towards technique by just accepting that its work. The motivation behind suggestopedia watch to upgrade learning by taping into the intensity of proposal. Suggestopedia is framework for freedom from the 'fundamental negative idea in regards to the challenges during the time spent learning'. Suggestopedia is educational use of proposal. It causes students to conquer the feeling that they can't be effective and expel their psychological hindrances to learning. New Age Devices

This year, the purchaser Electronics Show which was held at Las Vegas, gave a look at pivotal gadgets simply implied for understudies. These masterpieces extended from 3D printers to shrewd watches. The adolescent's necessities are coordinated by another age gadget, be it studies or web based life, travel or transportability. The media spilling gadgets like the Google chrome cast and the Rokku make gathering studies become intelligent and introductions shockingly satisfied one. One needs to stream the media on to a keen TV utilizing dongle. Another gift is the tablet for the progressing age. The all new-fuel paper white is a help. Understudies can simply take care of the tablet for simple reference. The versatile report scanner like the Doxie Flip Cordless Flatbed Photo and scratch pad scanner are utilized to get notes arranged. Different gadgets like duplicate and Olympus which have accompanied voice recorders can be used to record all the English talks and be played as and when time grants. A Common Frame Work of Reference for Languages intends to give a typical premise to the elaboration of language prospectuses, educational plan, what students need to realize aptitudes they need to grow in order to have the option to act viably. A reasonable portrayal of the substance regarding phonetic competency, sociolinguistic competency and down to business competency establishes a language. Utilizing descriptor scales, student's capability is estimated. Descriptors comprise of a progression of can do articulations which got a lot of consideration. The student's association and educator's strengthening are worried during the instructing and learning forms. The regular strategy for instructing wherein the instructor appreciates the restraining infrastructure of educating some of the time even decimates the weight of the students. Job of Modern Teacher Researchers characterized the term job as specialized term which initially originates from human science and alludes to the mutual desire for how an individual ought to carry on. A few systems



have advanced various jobs for a language educator. Richards and Rodgers imagine an educator's job as a piece of plan, part of a technique. Little Wood conceptualized the job of the instructor as a facilitator of learning, a regulator, a study hall director, an expert or guide and now and again a co-communicator with the students. To Harmer, an educator assumes the job of controller, coordinator, assessor, advertiser, member, asset, guide and onlooker.

Undertaking Based Language Teaching is the present worldview is fundamentally an offshoot of Communicative Language Teaching. Exploratory learning or learning by doing as the fundamental calculated reason for the TBLT. The TBLT separates the obstructions of the conventional study hall, on the grounds that in the TBLT, the job of the student is altogether changed. The educator turns into a genuine facilitator or learning for the language students, absolutely by methods for dialogic correspondence. The educator's job isn't avoided by and large yet is limited: the instructor is required to be control by the side. The job of instructors in what capacity will depict as pursues: 1. Facilitator 2. Free member 3. Needs examiner 4. Guide 5. Gathering preparing chief

### Conclusion:

Across the world, data innovation is drastically changing the way understudy; personnel and staff learn and work. As the interest for innovation keeps on rising, schools and colleges are moving a wide range of understudy administrations, from clothing observing to nibble conveyance on the web. Innovation is additionally changing the homeroom experience. Furthermore, tablet PCs, smaller PC that enable you to compose notes straightforwardly onto the screen with an exceptional pen, supplant the age-old projector. With the tablet innovation enable educator to make notes on diagrams and spreadsheets and send them legitimately to their understudy's PCs. The conventional technique lays more accentuation on an instructor himself and is educator focused. Dreary practice, mechanical drills and remembrance are the signs of the customary strategies. Job of the instructor is to relate to the since quite a while ago treasured customary idea that educational standards rely upon how articulately an educator instructs. It is basic to comprehend the present patterns and evaluative techniques for the ELT. The scientists accept that the metal target of educating is passing on the data or information to the psyches of the understudies. Any technique utilizing PCs or altering the current ordinary chalk-talk strategy are imaginative on the off chance that they eventually serve the accomplishment of center target of educating.

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## ENGLISH LANGUAGE ERRORS IN NON-NATIVE STUDENT-COMPOSED TEXTS OF DIFFERENT REGISTERS

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**Abstract:** - Research of linguistic features requires part of speech (POS) tagging of texts. The existing POS taggers have been predominantly trained on native speakers' texts to enhance their accuracy. The researchers exploring POS tagging of ELL (English language learners) texts distinguish tagger's and learners' errors and suggest annotation enhancement schemes. However, the frequency and types of CLAWS7 (Constituent Likelihood Automatic Word Tagging System) tagging errors in ELL texts of different communicative purposes have not been sufficiently explored to suggest annotation enhancement solutions in each particular learner corpus building case. This study investigates CLAWS7 tagged texts composed by non-native English philology BA students (English Studies Department, University of Latvia) to uncover the overall precision of the tags having the greatest impact on the error rate and provide an insight into errors to reveal the texts requiring annotation enhancement solutions. Material for the analysis has been selected from the corpus of student-composed texts. The results show that tagging precision varies across the text groups. The texts edited by the students show greater tagging precision, and therefore would not require specific annotation enhancement procedures before their tagging. Tagging precision is lower in such interactional texts as chat messages that could be addressed by the application of an annotation enhancement scheme.

**Key words:** corpus, annotation, accuracy, tagging error

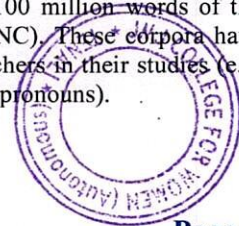
### INTRODUCTION

Scholars (e.g. McEnery et al., 2006; Reppen, 2010) point out that the investigation of a wide range of linguistic features, for example, in the texts of various genres can be explicitly performed on part of speech (POS) annotated texts. This assumption refers also to non-native English language learners' texts. Aarts and Granger (1998) have already drawn attention to the fact that POS annotation of learner corpora can reveal their language use in detail. Meanwhile POS annotation taggers, such as CLAWS7, have been trained and predominantly used to tag texts composed by native speakers. Even if its overall performance on native speakers composed

texts is recognised as high, there is comparatively modest research on CLAWS7 performance on non-native student-composed texts of different genres. The goal of the present study is to tag the text samples composed by BA students of English philology (the University of Latvia) with CLAWS7 and subject them to quantitative and qualitative analysis of examples to uncover the tagger's and students' errors of the most frequent tags leading to an ambiguous assignment. This would reveal the text groups requiring annotation enhancement solutions or editing of CLAWS7 assigned tags in the learner corpus creation process.

### THEORETICAL BACKGROUND

POS tagging, also known as morpho-syntactic annotation, is the process during which a POS tag is assigned to each word in a text corpus. Leech explains (1997: 2) that annotation 'enriches the corpus as a source of linguistic information for future research'. Reppen (2010: 35) adds that annotation can substantially relieve parts of speech distinction. For example, in POS annotated corpus, the search of the noun *well* would be more effective than in raw corpus because it would exclude all the instances of the adverb. Linguists (Leech, 1997: 4-5; McEnery, 2003: 454-455 referred to by McEnery; Xiao and Tono, 2006: 30-32) have summarised the following main benefits of annotated corpora in linguistic research: (1) the ease of linguistic information extraction; (2) reusability as well as reusability for the purpose that differs from the initial research question; (3) a source of objective record for analysis. McEnery et al. (2006: 34) note that POS annotation for the English texts is considerably developed to perform automatically by taggers with the precision rate suitable for various research questions. One of such taggers is CLAWS7 that has been developed at Lancaster University (Leech et al., 1994). Its overall accuracy rate is 96-97 percent for written language texts, and therefore, being acknowledged as a high accuracy tagger, has been widely applied in tagging native texts, e.g. the Lancaster-Oslo-Bergen Corpus (LOB) corpus and also c. 100 million words of the British National Corpus (BNC). These corpora have been widely used by researchers in their studies (e.g. Adami, 2009, in research of pronouns).



Learner corpora compilers and researchers have primarily devoted their attention to learner text error tagging, e.g. Granger (2003) as well as developing annotation schemes for English language learners' non-word (spelling and morphological) errors (Hovermale and Martin, 2008) as a precondition for POS tagging of learner corpora towards the development of annotation enhancement schemes. CLAWS7 for its comparatively high accuracy has drawn researchers' attention and has been applied to POS tagged non-native students' essays and letters. Van Rooy and Schaffer (2003) have explored and found promising results on the overall accuracy of CLAWS7 in comparison with two other taggers TOSCA-ICLE and Brill on the sample of non-native students' essays. Twardo (2012) has applied CLAWS7 tagger in the investigation of the learners' essays and letters (levels B1 –C1) with the aim to focus on learners non-word errors. The comparatively promising results on CLAWS7 and its applicability in tagging non native students' text samples has called for its application in tagging of a wider range of non-native student-composed text samples in the present study to pretest the tagger for further annotation enhancement strategy solutions.

#### MATERIAL AND METHOD

The analysis material has been selected from the corpus of the second year student composed texts (STUDTEXREG) compiled for investigation of register-based variation of linguistic features at the English Studies Department, University of Latvia. The corpus texts are arranged into six groups (220,012 tokens) according to their communicative purpose: statements, essays, letters, virtual conference messages, chat messages and discussion messages. To make the investigation more feasible, the randomly selected text samples, in total 10,000 tokens, were subjected to CLAWS7 tagging analysis. Samples of 3000 tokens have been selected from each of the three text groups (letters, discussion messages and essays), whereas 1000 tokens from chat messages. The error counts have been calculated on normalized texts (i.e. per 1000 tokens), as the text length differs across and within the genres. For example, chat and discussion messages are considerably shorter than essays.

The tagger's performance evaluation methodology proposed by Van Rooy and Schaffer (2003) has been applied in the present study. These researchers have based their evaluation on Van Halteren's (1999) considerations of a tagger: its tagset, documentation, the tagging process and performance of the tagger. CLAWS7 tagset contains 137 tags (excluding punctuation tags), its documentation is available on University Centre for Computer Corpus Research on Language (UCREL) site (see Leech et al., 1994) and the tagging process is comparatively fast. CLAWS7 overall performance has been investigated by Van Rooy and Schaffer by comparing three taggers on the learner texts and they have found that CLAWS7 is the most accurate on non-native students' texts among all three taggers (CLAWS7 96.26 %, TOSCA-ICLE 88.04% and Brill 86.34%). These results show that CLAWS7 obtained results on non-native students' texts that correlates with its overall accuracy on native speakers' texts, which is 96-97 percent.

However, in order to reveal particular error types and causes, they have identified the tags with generally the lowest precision (*RGR*, *RRR*, *DDQ*) and the tags that due to their frequency contribute most significantly to the overall error rate (*NNI*, *JJ*, *VV0*, *NDI*). CLAWS7 tagset information is placed in Appendix 1. Therefore, in the present study, the frequency of the previously mentioned lowest precision tags and the tag that significantly influence the error rate has been calculated to check their frequency in the selected analysis material – student-composed letters, essays, chat messages and discussion messages. As it is seen in Table 1, the most crucial for tagging precision of the students' texts are *NNI*, *JJ* and *VV0*, as it was expected in the light of Van Rooy's and Schaffer's (2003) findings. Finally, the precision, i.e. the number of tokens that have really received *NNI*, *JJ* and *VV0* correctly, was calculated: the number of the tokens that have received a correct tag was divided by the total number of tokens.



Table 1 The frequency of tags

Tags	Chat %	Letters %	Discussion %	Essays %
RGR	0.09	0.04	0.13	0.26
RRR	0.09	0.04	0.07	0.35
DDQ	0.89	0.72	0.40	0.62
NN1	7.58	16.56	13.20	15.20
JJ	4.50	8.88	6.97	6.80
VV0	2.59	0.96	2.44	2.17

RESULTS AND DISCUSSION

Tagging precision of the three selected tags is shown in Table 2. Even if the overall precision is promising,

the actual cases of errors differ across the text groups and therefore the error cases from each text group will be exemplified and discussed.

Table 2 Tagging precision

Texts	NN1 %	VV0 %	JJ %
Chat	86.40	88.46	88.88
Letters	92.27	98.19	92.30
Discussion	93.13	96.17	96.72
Essays	94.67	92.50	85.65

The lowest precision, in comparison with CLAWS7 overall performance rate, is displayed by chat messages, which can be explained by the fact that they are interactional, instant and, thus, unedited texts. The bulk of the tagging mistakes are caused by the tagger (76.66%) and also by students' (23.40%) errors (non-word and word errors). The non-word errors have been classified by researchers (Hoover and Martin, 2008: 3) into spelling errors (words where letters are switched, missing or added) and morphological errors (words which are composed of two correctly spelled parts, but the parts themselves are not correct, e.g. *tooked*).

One of the most common tagger's errors is verb/noun confusion as in the case of the word *finish* (example 2) and also noun/adjective confusion as in the case of the word *sausage* (example 1) and hence the faulty assignment of *NN1*.

(1) What\_DDQ is\_VBZ white\_JJ sausage\_JJ/NN1 line\_NP1

(2) Lets\_VVZ finish\_NN1/VV0 and\_CC go\_VV1 home\_NN1

The second group of errors refers to acronyms that stand for organization names and have been tagged in

a confusing way (see examples 3, 4), in this case by assigning the tag *JJ* or *NN1*, which means that the quality of the proper noun has not been recognised by the tagger. The same refers to fictional proper nouns and authentic proper nouns (see the example in the reference to essays).

(3) EPICTC- JJ/NP1

(4) MUNO\_NN1/NP1

The third group of errors is due to foreign words in the text, as CLAWS7 is the English text tagger. Example 5 shows that the greeting in the Spanish language *hola* has been wrongly tagged as *NN1*.

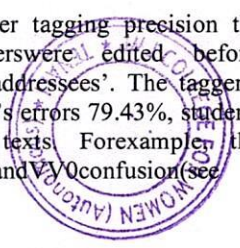
(5) Hola\_NN1/UH

Such specific features of chat messages, as seen in examples 6 and 7, have been perceived by the tagger as nouns.

(6) yeeeeeee\_NN2

(7) Yeeeeee\_NP1

Letters display higher tagging precision than chat messages, as letters were edited before their submission to the 'addressees'. The tagger's errors are prevailing (tagger's errors 79.43%, students' errors 20.58%) in these texts. For example, there are repeated cases of *NN1* and *VV0* confusion (see



examples 8 and 9) in these texts. Example 10 shows that the students' use of clipping 'biz' for *business* has been recognised by the tagger and tagged correctly; however, the abbreviation 'gov' that in this text stands for *government* is mistaken by the tagger for the common abbreviation that stands for 'preceding the noun of title'.

(8) Should\_VM the\_AT Eutrope\_n\_ JJ  
Commission\_NN1 coordinate\_ NN1/VV0 or\_CC  
advise\_VV0

(9) Elton\_NP1 Jackson\_NP1,\_, pop\_VV0/NN1  
king\_NN1

(10) gov\_NNB/NN1 and biz\_NN1

Tagging precision of discussion messages is similar to the precision of letters, even if discussion messages are instant, unedited texts, and obviously, therefore, most of the faulty tags are due to the students' errors (57.55%) that is seen in example 11 (spelling caused confusion of the part of speech), example 12 (the introduction of a space between the word *instead*) and example 13 (the omission of an apostrophe). Examples 14 and 15, however, display the confusion of tags *NN1*, *JJ* and *VV0*. The word *kind* (example 14) is obviously used as an adjective characterising the quality of *words* and the word *work* is used in the function of a noun, whereas in example 16 *identify* is a verb.

(11) activity\_NN1 about\_II weather\_NN1/whether\_CS Wi  
t\_PPH1 is\_VBZ

(12) in\_I instead\_NN1 of\_IO/instead\_II21 of\_II22

(13) Im\_VV0/I PPISI'm\_VBM

(14) about the\_AT kind\_NN1/JJ,\_, pleasant\_JJ  
words\_NN2

(15) should\_VM reread\_VV1  
his/her\_PPG Ework\_VVO/NN1

(16) identify\_NN1/VV0 falsification\_NN1

Essays that have been the most carefully edited texts generally display similar tagging precision to the other texts apart from highly interactive chat messages.

However, they also display the students' errors that cause the assignment of wrong tags. Thus, example 17 shows a non-word error, a spelling mistake that has led to the wrong tag assignment. Examples 18 and 19 also show the tagging result of the fused spelling of *is not* and *cannot*. Examples 20 and 21 demonstrate that the tagger has not recognized the proper nouns, in this case the place names: the fictional place name *Bardland* and also part of the authentic place name *Britain* has not been tagged precisely, obviously because of the spelling mistake in it.

(17) sitting\_VVG in\_Ia\_AT traffic\_NN1 tram\_NN1

(18) People\_NN who\_PN QS live\_VV0  
here\_RC cant\_NN1/VM ...

(19) It isn't\_VV0/VBZ

(20) Great\_JJ Britan\_NN1/NP1...

(21) Bardland\_NN1/NP1 supports...

## CONCLUSIONS

The analysis of unedited samples of CLAWS7 POS tagged texts that were explored reveal a promising tagging precision. However, the particular error cases vary across the texts grouped according to their communicative purpose. Even if the tagger's error analysis displays regularities (e.g. *NN1/VV0* confusion, etc.), these specific features of particular text groups, due to their communicative purpose, have to be taken into account because they can lead to specific tagger's errors (e.g. fictional proper names have not been recognised by the tagger as proper names, foreign words, curious abbreviations). Therefore, the samples of each group of texts envisaged for the inclusion in the corpus should be tested and considered for the following tagging enhancement options. (1) In case the texts, unedited and interactional (e.g. chat messages, email messages), tend to contain students' errors (word/n on-word) that could cause faulty tag assignment, a students' error tagging scheme should be applied in parallel with POS tagging and the tagger assigned tags should be post-edited. (2) In the case of students' edited texts developed on the basis of several drafts (e.g. untimed essays, papers) that hardly contain any language mistakes, manual or semi-automatic editing of the tagger assigned POS tags can be applied. Additional, more exhaustive research of tagging students' transactional and unedited interactional text samples could further contribute to these preliminary conclusions.

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## The Preschool Curriculum by Young India

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### Definition of Preschool

Preschool training is schooling imparted to youngsters in three-6 years age organization. It is the first level of organized training. Preschool training is likewise called pre-primary training. It's miles provided in any of the settings which include Anganwadis, Nursery colleges, Preschools, Preparatory schools, Kindergartens, Montessori schools and Pre-primary sections located in authorities and private faculties. Imaginative and prescient of Preschool training Preschool schooling envisions selling access to familiar, equitable, pleased, inclusive and contextualized getting to know possibilities for making sure holistic development of all youngsters between three-6 years of age. These can be ensured via concerning dad and mom and teachers in supplying an emotionally supportive, culturally rooted, baby oriented, and stimulating studying environment. It targets at maximizing man or woman capability by way of developing strong foundations for lifelong gaining knowledge of via play and developmentally suitable practices. It additionally intends to increase healthy mind-set, right values, and talents of vital wondering, collaboration, communicate, creativity, era, literacy and socio-emotional improvement. It ensures clean transition from preschool to primary faculty, therefore, permitting youngsters for effective and enjoyable existence in destiny.

### Step 1 Aim of Preschool Education

The overarching targets of Preschool training are z imparting robust foundations for all round development and lifelong gaining knowledge of z preparing the child for college.

### Objectives of Preschool Education

- To make certain child friendly surroundings in which every baby is valued, reputable, feels safe and at ease and develops a wonderful self-idea.
- To allow a legitimate basis for precise health, nicely being, vitamins, healthful conduct and hygiene.
- To allow kids to grow to be powerful communicators and foster both receptive and expressive language.
- To assist children turn out to be involved newbies, suppose significantly, be innovative, collaborate, talk and connect with their on the spot environment.
- To allow an easy transition of youngsters from preschool to primary colleges.
- To paintings as companions with mother and father and community to allow each baby to flourish.

### Characteristics of Preschool Children:

on the preschool level, youngsters are curious and enthusiastic about the colors, shapes, sounds, sizes and forms round them. The kid's potential to experience the world receives richer and extra differentiated through the years. This early studying takes area as part of conversation with adults and friends in which language also plays a very important function. Youngsters want to accept opportunities to investigate, discover, and increase an information in their on the spot and wider surroundings – human, social and cultural. In the exploration of their environments, youngsters are worried in statement, questioning, dialogue, prediction, analysis, exploration, investigation, and experimentation. In this method they construct, modify, and expand a huge variety of principles and thoughts. Kids begin to manage their very own emotions and feelings, research sharing, turn taking and cooperating with peers. Children begin to tell others while they may be glad or sad. Additionally they broaden their self-idea. The prevailing curriculum, consequently, includes the unique content material and pedagogy to in shape the age and developmental requirements of this degree and finds its base from the theoretical and conceptual frameworks inside the shape of the guiding concepts. This no longer simplest affords the required flexibility in phrases of age, given the variety in policies, however also caters to the realities of multilevel; multi age classrooms and guarantees a smoother transition from preschool to early primary instructions leading to fantastic self-idea and self-belief, better overall performance and better retention fees.

**Guiding Principles for Preschool Curriculum:** in the mild of rising wishes and new developments in preschool schooling, a strive is being made to ensure that the prevailing curriculum is holistic, developmentally suitable, indigenous, and most significantly play and activity based. Consequently, the curriculum is drawn from the subsequent guiding concepts:

**Learning is continuous and cumulative:** gaining knowledge of starts at delivery and continues over life. When you consider that, youngsters research thru senses and 4 Curriculum for Preschool training stimulations, the early care and stimulation have a cumulative impact on their development, it is imperative that youngsters inclusive of people with unique wishes are furnished with most fulfilling stimulation within the early years.

**Evidence from neuroscience proves that early learning matters for later outcomes:**

Neurobiological research shows that pathways set in the very early years of a infant's existence program the methods in which youngsters examine. even as genetics performs an critical role inside the manner brain is established, it is often a baby's early studies which are important in determining how the mind will in the end, be formed.

**Each child is different and grows, learns and develops at her/his own pace:**

even though all youngsters largely comply with the same sequence of improvement, every infant is particular and acquires capabilities and skills at his/her own tempo. a great preschool program respects different skills and man or woman tempo of

improvement of children and ensures that all children increase bodily, socially, emotionally, morally and intellectually to their complete capability. The curriculum follows developmentally suitable practices (DAP) which are suitable to their age, level and context to sell kids's most appropriate studying and development. It suggests using a couple of teaching techniques to deal with the needs of children at the different developmental stages.

**Play and activity are the primary context of learning and development:**

Play and interest are the nice medium for preschool training. They offer possibilities to explore, test, manipulate and enjoy the surroundings as a consequence, children assemble there.



Information. The curriculum suggests play sports, having a balance between one-of-a-kind forms of play like free and guided, energetic and passive, indoor and outdoor, character and organization and dependent and unstructured. A giant part of play must offer opportunities for self-initiated play/activities which emerge from kids's hobby and picks.

**Step2. Some Concerns Related to Early Learning and Development:**

1. **Handle Variation in Learning:** In a class wherein children vary of their getting to know abilities and getting to know fashion the teacher must, moderate the learning surroundings for assembly various learning needs of the youngsters. Recognition on what youngsters need to research or how they will get entry to to the statistics. Design activities wherein the child engages to make feel of or collect the content. Culminate initiatives that enable the youngsters to rehearse, practice, and amplify what they have got learnt in a topic. allow kids to work in different businesses -from time to time with children at equal degree of readiness

or with blended-readiness corporations, with kids having similar pursuits or with children having distinctive pursuits, with friends who learn as they do, or randomly, and often with the magnificence as an entire. Divide the complete group into two companies of children with varying abilities and a while. While the more youthful age group of children with emerging capabilities is engaged in loose play the instructor conducts the guided activities with the older age group of youngsters with higher capabilities. After a duration of 30 minutes the instructor can conduct guided sports for the younger age institution of kids with emerging competencies at the same time as the older age group of youngsters are engaged in loose play. Consequently the instructor might be capable of manipulate the varying skills and age groups through developmentally appropriate sports.

**2. Ensure Careful Inclusion of Children With Disability :**

Encouraging the improvement of children with disabilities through early intervention, minimizes getting to know difficulties and hurries up child

development. It also reduces the charges by means of minimizing the want for special training offerings. Early intervention consists of a system of offerings tailor-made to character desires, that purpose to help youngsters directly and additionally through presenting help to their mother and father. Early intervention may be supplied in several paperwork: Speech and language remedy can help in enhancing listening

to and the usage of listening to aids. Physiotherapy can assist in development of motor abilities consisting of, stability, sitting, crawling and on foot. Improvement and paintings remedy can assist increase motor abilities of arms, play, cognitive, social emotional and improvement for self-care. Assistance technology equipment that a child can also need.



#### **Inclusion:**

Provides a possibility to treat youngsters with disabilities equally and cognizance on their abilities. This empowers them with adequate facilities, infrastructure and personal assist. Therefore, perform the early developmental screening of all youngsters and pick out their strengths. Understand the importance of early identification and intervention. Make modifications in the physical environment to ensure it's miles barrier loose. Make curriculum flexible and on hand to youngsters with exclusive impairments. Expand appropriate evaluation and assessment techniques. Build the potential and empower all the stakeholders to revisit their very own attitudes and work toward converting them if required. Regularly inspire them to use fine terminology whilst running with kids with disabilities. Use age suitable play and gaining knowledge of material. Sensitization; orientation; training; and counseling of dad and mom and network need to be completed.

#### **Step3.The Curriculum:**

Kids are born with an extremely good ability and preference to analyze. it is important that children are furnished with rich reviews through play and sports that develop critical questioning and hassle-fixing, understanding approximately themselves which are age and developmentally

suitable. Pedagogical practices must consist of sports and stories for all domains of improvement together with-cognitive, socio-emotional, language and literacy, bodily-motor and innovative and aesthetic which are interlinked. Enough possibilities have to be supplied to explore, recognize, test, experience and transform records into significant content and talents.

The present curriculum covers the 3 broad goals, key talents and ideas to be evolved, pedagogical approaches to be used by the academics and the early studying effects to be done via the youngsters on the cease of Preschool I, Preschool II and Preschool III. Early getting to know consequences ought to be observed an Assessed in a continuous and complete way with a view to provide scope for development.

#### **Goals of Preschool Education**

Studying and development in children is holistic, it advances in the regions of health, cognition, non-public and social improvement and wellness concurrently. Youngsters research at distinct times, in unique methods and at special charges. The aim of preschool education is to facilitate premiere improvement of infant's complete capability and lay the muse for all round improvement and lifetime mastering. The curriculum addresses all of the domains of improvement via the subsequent 3 extensive desires.

Intention 1: youngsters maintain desirable fitness and wellness the early childhood years are of crucial significance for laying the foundation for most effective bodily, socioemotional and psychological fitness and nicely being of kids for life. These are the years while children, given the right opportunities and encouragement, are growing the 5 senses, strengthening their larger and finer bones and muscle tissue and refining their eye hand coordination, which is likewise one of the stipulations for being capable of write. alongside, their sense of identification and social abilities are developing, as they provoke and engage in an increasing number of play based sports with other children, first of all in pairs and then regularly in smaller after which larger businesses as they discover ways to play, work and stay with others in harmonious approaches. in addition they start to respect how every certainly one of them is unique and how these variations need to be now not only accepted but respected.



maximum critical of all, youngsters want to revel in a experience of autonomy and confidence of their very own developing abilities and achievements and expand accurate fitness conduct leading to suitable physical fitness and improvement of self-confidence and a wonderful self-idea, which if Early getting to know outcomes should be located an Assessed in a continuous and comprehensive manner with the intention to provide scope for improvement. The Curriculum 13 correctly nurtured, will stay with them for existence. All this receives facilitated if the gaining knowledge of and play stories they get offer possibilities to them to take initiative and also are enticing and difficult for them, and yet inside their region of capability, to allow them to revel in more of achievement than failure. This approach might assist them inculcate an interest in studying new things, have interaction and persevere on new and habitual duties and adjust their very own feelings and efforts, all of which are talents that make contributions to success and properly being in existence.



**Goal 2: Children Become Effective Communicators**

by the time three yr olds come right into a preschool in monolingual cultures, they've normally already begun to communicate their wishes and likes and dislikes orally in their home language, which is also the faculty language. Similarly, in more literate families, children are from infancy (0-2 years) exposed to books and to reading through tale telling by elders or by means of seeing others studying as role models. The preschool curriculum is therefore required to build on a majority of these early reviews and exposure and similarly children's conversation competencies so that it will orally proportion their thoughts and feelings or describe their reviews greater effectively, be capable of get hold of and proportion statistics and develop better order competencies of important and innovative thinking. They step by step go on to additionally discover ways to study and write with comprehension in that language. However, this situation is feasible most effective in contexts in which the medium of instruction or interplay in preschools and colleges is similar to the child's home language, in which the kid has already received a few competence at preschool entry.



goal 2: youngsters emerge as involved novices and hook up with their instantaneous surroundings: The younger infant is curious and enchanted about the

arena – its shades, its shapes, its sounds, its sizes and its paperwork. However maximum of all she is enchanted with the human beings – to start with her immediate care givers, however additionally others. This ability to hook up with others and to proportion emotions with them lays a special foundation for learning- the cultural social foundation of human learning. the child within the preschool years begins to understand the world round her through making sense of it as she ‘sees’ it. If a set of 5 pencils is specified in a way that it's far unfold aside and covers extra space, while some other set of five is located near collectively and covers much less space, preschoolers will tend to see the latter as having much less pencils, despite the fact that the range is the equal! They're ruled by means of the space blanketed as they see it and now not by means of the idea of quantity which remains growing.

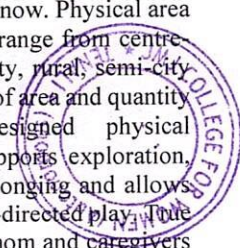


a first-rate intention of preschool education is consequently to help kids circulate toward greater logical thinking by means of supporting them graduate from their perception-bound to extra concept based totally know-how. This receives addressed by means of assisting youngsters form ideas related to the world around them thru direct enjoy and interactions with the bodily, social and herbal environment. a valid framework for making plans their studying reports to apprehend the surroundings will be to assist them expand knowledge or knowledge for the environment, via the surroundings and of the environment.

Mathematical thinking and reasoning: Mathematical wondering and reasoning is a vital sub -domain of cognitive improvement. The muse for this abstract rule-based totally wondering The Curriculum 19 gets laid thru sports that are meaningful for the kid and which involve the whole infant. Mathematical questioning involves considering objects and their quantitative and spatial relationships without considering their unique traits or their features. First of all a experience about those relationships emerges and based totally on those the styles and the greater summary concepts expand. in the course of early adolescence, we can see a course of improvement for the foundational ideas of mathematics – from what are called pre quantity principles related to sense of amount, size, distance, length, width, weight and peak to number sense to arithmetic or algebraic ideas and from experience of form and area to geometrical thoughts. The preschool curriculum addresses this progression, the pedagogy for that is once more experiential, although mediated by language.

**Step4Designing a Child Friendly Learning Environment:**

Youngsters are lively and curious learners hence, their protection and mastering at the centre turns into the hardest venture. Designing physical area for younger youngsters blended with pedagogy and protection may assist of their system of getting to know. Physical area for young youngsters' sports may range from centre-to-centre and putting-to-setting (city, rural, semi-city and tribal) relying upon the supply of area and quantity of youngsters. A properly-designed physical environment handy to all kids supports exploration, offers young children a feel of belonging and allows them to engage in centered and self-directed play. The environment also makes dad and mom and caregivers



feel welcomed and worried. Given beneath are a number of the critical considerations while designing indoor and outside physical surroundings. I. Designing Indoor surroundings with hobby areas.

**(a) Activity Areas** Activity areas additionally called gaining knowledge of centers, are hooked up locations within the classroom with resources that actively interact children and they'll trade according the themes or subjects.

**(b) Importance of Activity Areas** playing in interest areas allows youngsters exercising their picks and discover what interests them. It provides possibilities to create, draw, manage, discover, examine new competencies, make mistakes, modify their strategies and offers a sense of fulfillment after they have mastered the pastime in which they were engaged consisting of constructing a tower, fixing the jigsaw puzzle or fixing a maze. It helps of their socio-emotional development, as youngsters discover ways to play with other youngsters, share ,take turns in using the material, wait till the opposite child finishes his/her pastime. They research time management in addition to self-law. It enables in first-class and gross motor improvement as children play with water, sand, control matters. Kids learn how to clear up issues, offer motives, discover new fabric, and make selections for this reason supporting in their cognitive development. looking at youngsters at the same time as they are worried inside the pastime place specially, doll nook and dramatic play well-known shows a lot approximately toddler's contexts-own family, interactions, relationships, pent up feelings/bottled up feelings, which can be used by the teacher.

**(c) Setting up Activity Areas** activity regions ought to invite and promote active, independent exploration

and discovery, growing an environment wherein kids can research. It should incorporate a selection of manipulative and materials that kids can use in innovative approaches. The substances ought to be displayed and stored attractively at the open cabinets for clean accessibility to inspire exploration. The fabric ought to be stored in this sort of manner that kids can start gambling without grownup assist, and be able to set up the material and smooth up when they have finished playing. There have to be enough material in each interest location so that youngsters don't fight or compete over one toy. Each lecture room may also have numerous hobby regions such as- artwork area, block building location, doll and dramatic play place, maths/manipulative vicinity, technological know-how/discovery area, music and movement vicinity, sand and water play region, eBook studying place and so forth. Those areas may also be created on a rotational foundation as per curricular wishes. Lecture room shows lecture room presentations are very important in preschool lecture rooms. Presentations may be used to bring a theme being protected inside the classroom. This makes kids curious and interested in the topic. Samples of kids's work can also be displayed on the show board. the subsequent have to be saved in mind whilst displaying kids's works: shows need to be at the eye degree of children on the way to see them easily Samples of each in-procedure and completed work of youngsters have to be displayed in order that the technique of learning is likewise valued because the final product presentations ought to be modified often paintings of every toddler need to be displayed, no longer the nice ones (may be on rotational foundation) presentations must be functional.



an excessive amount of display need to be prevented because it makes the school room appearance cluttered

or over-stimulating shows must be relevant and contemporary.

#### **Step 5 Pedagogical Approaches for Curriculum Transaction**

**Theme Based Approach** topic-primarily based technique is normally used by the educators across the world. It tries to tie in diverse capabilities and expertise to be acquired by children, right into a coherent whole, prepared around a specific topic, which includes myself, flora, animals, end result, veggies, and many others. A deliberate consciousness on a given subject matter permits even very young kids to be greater efficient in obtaining competencies and procedures required to accumulate and technique statistics in later life.

**Play Based Approach** youngsters study exceptional thru play. kids need to interact in play sports that are neither too difficult nor too easy for his or her developmental degree. In a play primarily based method stimulating substances and sports are made to be had with the aid of the instructor and youngsters self-pick out activities consistent with their hobby at each point of time and research at their personal pace. the academics position is that of a facilitator and she does now not carry out any precise dependent sports.

**Activity based Approach** the number one perception of pastime-based approach is that youngster's research thru participation in activities, which provides possibilities for exploration and experimentation with special coaching mastering fabric. The sensory enjoy and movement make the gaining knowledge of better and extra impactful. This ends in an interesting adventure of discovery and enhanced understanding. A preschool instructor embeds the getting to know desires in various varieties of sports consisting of out of doors and indoor play, storytelling, art and tune activities, prepared in a preschool elegance.

**Projects /Inquiry based Approach** A undertaking is inquiry based totally, research or in-depth look at of a subject or theme, commonly executed by using small corporations within a class, a whole elegance or sometimes via character youngsters. the teachers gives a few open-ended triggers and then observes the kids, concentrate to their tales, their questions, see how they navigate the interest, pay attention to their hobby ranges and speak with the youngsters. kids decide what they want to know more about and look into similarly.

#### **Step 6 Assessment in Preschool Education Assessment Tools and Techniques**

Assessment can be performed through using various tools and strategies:

(a) Anecdotal information: brief written notes primarily based on observations of children - how and in which kids spend time, their social relationships,

their use of language, modes of interplay, statistics approximately health and nutrition conduct.

(b) Portfolios: A portfolio is a versatile and adaptable collection through the years of diverse concrete work samples showing many dimensions of the child's getting to know. This form of evaluation also focuses on the kid's strengths and demonstrations of knowledge and abilities. Samples of children's work in art, portray, craft work, collage making etc. also end up a part of the portfolio.

(c) Observations: statement will be deliberate purposefully for observing a child or institution of youngsters in particular situation. it is also carried out as an on-going herbal procedure in every day teaching studying activities. Remark achieved scientifically is source of legitimate statistics approximately infant's numerous character dimensions and studying development.

(d) Tick list: Checklists are a list of gaining knowledge of results, behaviours, or developments of an infant in a specific development area. A teacher is to determine whether or not those developments exist in a toddler or now not. She has to mark on the tick list as "sure" or "No" to signify whether a selected child exhibited a behaviour for the duration of that observational period.

(e) score Scale: A rating scale is a tool used for assessing the overall performance of responsibilities, skill tiers, approaches, processes, traits, quantities, or cease product. Rating scales are just like checklists except that they indicate the degree of achievement in preference to just sure or no.

#### **Step 7 Monitoring and Supportive Supervision**

Monitoring is the method to check the development of the programme, by way of amassing and analysing the facts about the programme. Supportive supervision, on the premise of the evaluation of the statistics collected throughout tracking, enables better control of the preschool, through guiding and enabling the workforce to carry out their roles and obligations optimally. Monitoring and supportive supervision isn't a onetime interest, alternatively it have to also be completed on an on-going foundation and optimistic comments should be supplied to the staff in a timely way. the focal point of monitoring and supervision ought to not be on fault-locating of individuals and reporting on them. as a substitute, the focal point must be on building the gadget so that it will achieve the desires of preschool education, assessing if there are any challenges/issues in the procedure, figuring out the foundation reasons of the problem, prioritizing the aspects to be addressed, finding answers and imposing them to make certain that kids are secure, and broaden optimally and participate in an awesome fine preschool programme.

#### **Step 8 Partnership with Parents and Community**

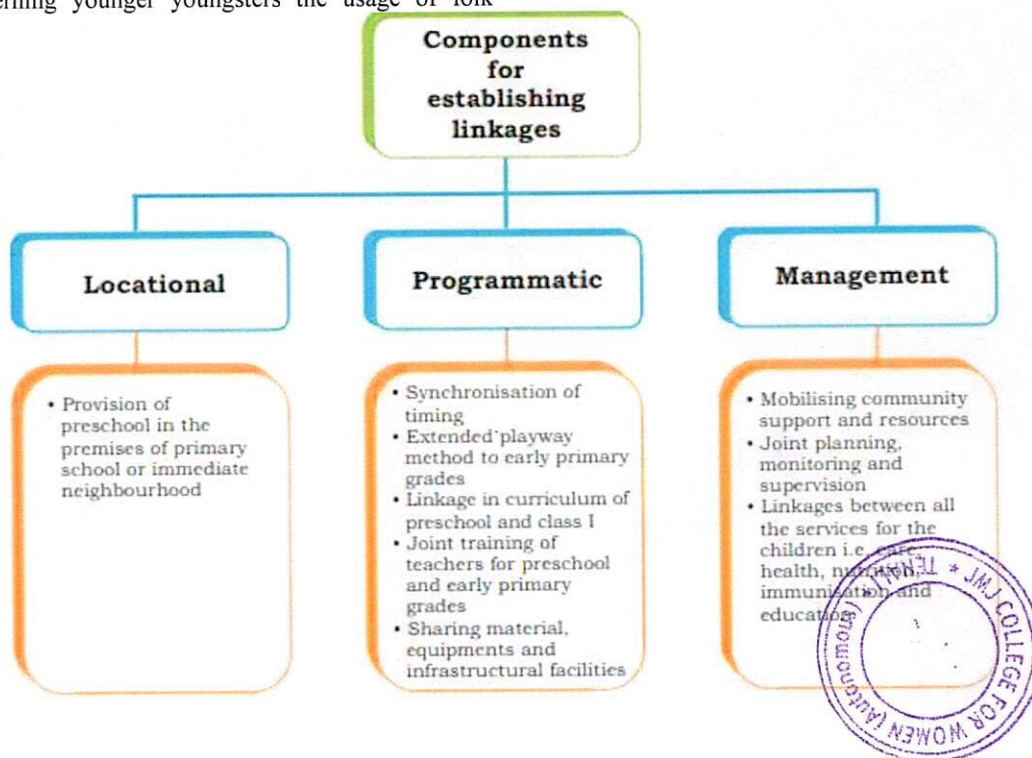
**Parent Education to support the child** discern education is necessary to ensure that anything is finished within the preschool is further reinforced or complemented at home. dad and mom may be taught simple abilities of recitation, story-telling, instruction of puppets and coffee-fee fun toys, and so forth. for kids on the way to assist enhance the first-rate of their interaction with the child and offer possibilities of children to play. They have to be made aware about : need for a comprehensive approach to improvement Age related milestones and the dangers of pushing a toddler beyond what she/he is ready for infant care i.e., emotional fitness and dietary desires of the kid at extraordinary stages of his/her improvement importance of play and early stimulation for the child's development Play manner method accompanied in the preschool programme and its need and motive eight Partnership with mother and father and network Partnership with mother and father and community seventy one role of parents and their support within the development of the child.

**Role of Community** The network is a vital stakeholder inside the preschool education programme. Involvement and participation of the network contributors might assist in expertise children and their circle of relatives better. Simplest if the network is aware, the desires of kids can be fulfilled. Network attention could be completed thru the following: consciousness generation Programmes which includes those incapacity related fantasy concerning younger youngsters the usage of folk

songs, street performs, puppet suggests, jathas, and so forth. Making preschool seen by organizing events in which community can take part like pageant celebrations, sports activities occasions, Bal-Mela, and so on. (a few mother and father can help in setting up and managing such activities) once the community recognizes the want of preschool education, possession of the preschool a few of the network contributors inevitably develops. It isn't always uncommon to have a look at network contributors helping the preschool in many methods, together with providing drinking water, ok area for the preschool and different resources. Few nearby contributors may be appointed in various capacities within the preschool. they may now not be certainly trained or qualified, but they may be capable of make a contribution in concrete methods over a period of time closer to the targets and functioning of the preschool.

**Step9: Supporting Children's Transitions**

Starting college is a major lifestyles transition for kids and their families. That is a time which may be both thrilling and hard on the same time. The kid and the households need to modify to new surroundings, new expectancies, new interactions and relationships. on this context it turns into vital that everyone children which include people with special needs are supported inside the transition manner from domestic to preschool and preschool to number one school. Consequently linkages between preschool and primary college ought to be hooked up.





In our country there exists a huge style of preschool servicesanganwadies, balwadies, privates preschools etc. having extensive disparity inside the infrastructural centers, instructor qualifications, curriculum and pedagogies. The age at which kids begin their pre-education also varies. Accordingly there are differences inside the ethos and strategies among various preschools. There are 4 foremost regions wherein children may revel in the lack of continuity which might also preclude their getting to know i.e.

- i. exchange in the physical environment
- ii. Differences in classroom organization
- iii. Content material of curriculum
- iv. Pedagogy and practices of preschool and early number one classes

preserving Continuity for easy Transitions the subsequent are some suggestive ways to make sure continuity of children's experiences: The early learning effects for children's mastering in preschool need to be linked with the mastering effects of class I. Preschools need to plot in this sort of manner that the dreams of curriculum are geared to the fulfilment of developmental needs of all kids inclusive of those with special wishes. The academics want to allow sufficient flexibility to make sure that the individual hobbies of youngsters in their preschool are met. Dad and mom and households should additionally be worried within the transition programme in order that youngsters can adjust better and adapt smoothly and without difficulty within the primary school. Training of preschool and sophistication I and II instructors need to be held collectively. Changes inside the new elegance and new experiences need to be slow instead of unexpected. Pre and primary school educators must coordinate and speak regularly which will put together children for the transition from preschool to number one. Visits of preschool children to magnificence I and II may be organized in order that they get familiarized with bodily surrounding and get familiar with environment without worry before the instructional consultation starts. The physical set up of classes I and II need to be planned in the equal way as that of Preschool (in toddler friendly table -chairs prepared in a cluster), hobby regions so as to assist youngsters proportion studies, develop trouble solving talents, coping capabilities, comply with rules and gain a experience of social and emotional nicely being. The play based totally sports need to additionally be a part of training I and II and in continuum of Preschool I, Preschool II and Preschool III. Class I teacher should go through the portfolios of preschool children a good way to help them to recognize their children higher. To finish all youngsters need to increase holistically, they need to be in a secure, at ease and stimulating environment and all this will be performed only if

there is a complete expertise, help and cooperation amongst all people who are concerned with the training of younger kids.

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#### Author's Profile

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## Parenting and Children's Lives in Present Days

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### Abstract:

Coverage makers and commentators often blame 'bad parenting' for youngsters' and younger humans' troublesome behavior. What can research inform us about the influence of parenting, especially the discern-child relationships in hundreds of thousands of 'regular' households?

■ Summarizes findings from seven critiques of current studies that were commissioned by way of the Joseph Rowntree basis to inform its own Parenting studies and development program.

■ Considers parenting from the perspectives of moms, fathers and youngsters themselves, in addition to the ones of black and minority ethnic dad and mom and households residing in poverty with constrained access to support offerings Editor:

### Key points

■ Differences in baby temperament, amongst different elements, exhibit that flexible, adaptable parenting is much more likely to be powerful than a 'one length fits all' method.

■ the fine of determine-child relationships suggests substantial stability through the years. Some dimensions of parenting are critical in youngsters' lives regardless of age, especially whether or not relationships are warm and supportive or marked by means of war.

■ Heat, authoritative and responsive parenting is usually important in constructing resilience. Dad and mom who develop open, participative communication, problemcentred coping, confidence and versatility have a tendency to manipulate stress nicely and assist their families to do the equal.

■ Young youngsters's relationships with their moms commonly have an effect on their improvement extra than father-toddler relationships. But teenagers' relationships with their fathers appear mainly important to their improvement and fulfillment in school.

■ Children's perspectives show that what younger human beings 'suppose' is not necessarily what dad and mom 'suppose they assume'. Parents generally tend to underestimate their personal have an effect on, however are also liable to take inadequate account of youngster's emotions at times of emotional pressure.

■ there's no causal link between poverty and parenting. But, poverty can contribute to parental strain, melancholy and irritability main to disrupted parenting and to poorer lengthy-time period effects for youngsters.

■ Policy, exercise and studies on parenting have made simplistic assumptions about parenting in black and minority ethnic communities. Stereotyped misunderstandings approximately 'tradition' and 'lifestyle' have contributed to failures to protect kids from abuse.

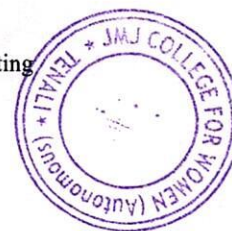
■ Dad and mom most in want of circle of relative's aid services are frequently the least in all likelihood to access them. proof shows that engagement can be stepped forward by way of: accessible venues and times for service delivery; trusting relationships among body of workers and users; a 'visible mix' of team of workers through age, gender and ethnicity; concerning dad and mom in decision-making; and overcoming prejudices concerning disabled parents, dad and mom with studying problems and mother and father with poor intellectual fitness.

### I. INTRODUCTION

As part of the making plans system for its studies and improvement programme on parenting, the Joseph Rowntree basis commissioned a series of heritage papers, such as seven overviews of existing studies literature. Political interest in parenting has tended to focus on hyperlinks between 'problem' behavior by kids and younger humans and dysfunctional households. in part because of this, the JRF programme has been mainly worried with parenting in 'regular' families, in search of a better knowledge of range in parenting and its implications for family regulations and support services.

This is contemplated in the topics protected via the evaluations:

- Parenting and results for kids
- Parenting and resilience
- Fathers and fatherhood
- Parenting and ethnicity
- youngsters's perspectives of parenting
- Parenting and poverty
- Barriers to inclusion



## II. PARENTING AND OUTCOMES FOR CHILDREN

Thomas G. O' Connor (college of Rochester) and Stephen Scott (Institute of Psychiatry) the methods that parents form their children's development have been a protracted-status supply of theorizing via scientists, philosophers and parents themselves.

Looking at a wide range of outcome research, the review concludes that the best of determine-child relationships is significantly associated with:

- gaining knowledge of competencies and educational fulfillment. Children's analyzing potential is associated with the studying surroundings round them and there's evidence that parental involvement with faculty is associated with fulfillment.
- Social competence (most usually studied within peer relationships). Parental warmth, lack of conflict, and manipulate and monitoring seem to play an critical position in developing youngsters's social skills.
- Kids's personal perspectives of themselves. Together with their feel of self-worth.
- Competitive 'externalizing' behavior and delinquency. The greater extreme the instances for parents, the worse the outcomes for children and probability of psychological disturbance.
- Melancholy, tension and different 'internalizing' troubles. Such as proceedings where physical symptoms are related to emotional pressure and social withdrawal.
- high-danger health behaviours. Such as smoking, illicit drug use, alcohol use, sexually risky behavior and, in some studies, obesity.

### Similarly:

- In most situations, there may be widespread stability within the excellent of own family relationships through the years, mainly when there may be a comfy bond of attachment between children and their parents.
- the satisfactory of figure-infant relationships seems to remain influential into adulthood for social and behavioural outcomes (although there were particularly few long-term studies).
- Some dimensions of parent-toddler relationships seem vital in youngsters's lives regardless of age, notably whether they're heat and supportive or marked by way of warfare and hostility.
- Different dimensions are concept to regulate in structure and feature all through children's improvement. One of the maximum critical may be tracking and control.
- Some associations between the first-rate of family relationships and youngsters's wellbeing appear to differ across sub-populations and cultures – along with those when it comes to bodily field.

- Genetic factors are an critical have an effect on on individual variations in parentchild relationships. The links among the nice of discern-child relationships and children's mental adjustment are mediated, in element, by way of genetic impacts.

- Differences in baby temperament, among other elements, exhibit that a 'one style suits all' approach to parenting isn't most excellent.

The review unearths that parenting programmers have increasingly emerge as visible as a count of public fitness. Improving the satisfactory of determine-infant relationships can be predicted to have positive results on man or woman kids, families and society as an entire. However, the extensive range of effects which can be related with the first-class of figure-baby relationships needs to be reflected in the way that parenting interventions are assessed.

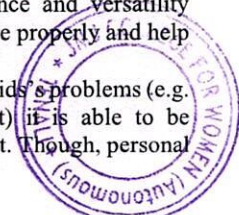
## III. PARENTING AND RESILIENCE

Malcolm Hill, Anne Stafford, Peter Seaman and Nicola Ross

This evaluation considers dad and mom's contributions to children's – and to their very own – resilience. 'Resilience' happens whilst accurate results come approximately for individuals or families within the face of adversity, or in which troubles would typically be predicted. Resilience-based exercise involves seeking out strengths and opportunities to build on, instead of for problems and deficits to remedy or deal with. Resilience can be displayed in numerous domains – emotional, social, instructional and behavioral. It's miles crucial, in terms of coverage and exercise, to take into account no longer only how parental resilience can improve children's properly-being, but additionally what assists dad and mom to be strong within the face of adversity.

To be had research indicates that:

- Mother and father, or opportunity caregivers, play a pivotal function in promoting the information, competencies and surroundings that can assist youngsters cope with adversity.
- Parents play a important element in mediating individual and community elements, at once or not directly. they are able to buffer youngsters from a number of the worst results of adversity inside the surrounding surroundings.
- Warm, authoritative and responsive parenting is generally critical in constructing resilience. Dad and mom who develop open, participative conversation, problem centred coping, confidence and versatility have a tendency to manage pressure properly and help their households to do the same.
- While parents are implicated in kids's problems (e.g. family violence and forget about) it is able to be doubly tough for kids to be resilient. Though, personal



characteristics and the guide of relied on friends or adults who healthy with their wishes, needs and expectancies could make a difference.

■ A number of the most hanging evidence approximately resilience comes from fostering and adoption. Youngsters with terrible health and development normally make rapid strides when they have received adoptive dad and mom.

■ studies points to 'hassle-centered' coping with the aid of dad and mom being extra a hit than avoidant or passive responses. This has been determined to help mother and father respond undoubtedly when they have a child with a severe incapacity or fitness hassle.

■ Colleges can play a important position in promoting resilience when it comes to each poverty and circle of relatives difficulties. This will relate to factors together with instructional stimulus, assist by way of teachers, learning opportunities and access to friends and friends.

■ Network elements can also sell resilience. kids are probably to locate it less difficult to access guide out of doors the home once they stay in cohesive neighbourhoods with formal facilities that encourage participation and achievement.

#### IV. FATHERS AND FATHERHOOD:

Connecting the strands of diversity Charlie Lewis (university of Lancaster) and Michael E. Lamb (college of Cambridge)

This evaluate looks at a few dimensions of fathering that want to be taken into consideration whilst knowledge the jobs performed with the aid of guys in present day households. Obstacles to a higher knowledge of fathering and fatherhood encompass a slender concentration on guys's roles as 'companies' and inattention to less visible factors of parenting. Fathers had been characterized too effectively as both 'superdads' and 'deadbeat dads'.

Men can variously fulfill the jobs of biological (reproduction), monetary (monetary provision), social (care giving) and criminal (responsible in law) fathers. Other essential dimensions of fathering encompass cultural and ancient situations, the social coverage context, individual motivation and the first-rate of relationships with moms. Higher understanding is needed of the changing hyperlinks among all these one-of-a-kind roles and their interplay over time.

Fathering issues that have obtained particular attention in latest research include:

■ Toddler care and fathering: even as the quantity of fathers' child care commitments has grown unexpectedly because the Sixties, fathers in dual-earner households nevertheless do much less with their children than moms. Greater involvement through guys does not seem like associated with accelerated

concord among partners. Depressed marital pride may also, but, replicate popular family stress.

■ Paternal involvement: The warm temperature of guys's relationships with their youngsters appears extra once they have proper relationships with the mothers, whilst the house is 'properly-organised', and whilst the own family engages in normal, shared activities. One have a look at determined youngsters's developmental progress became not on time whilst their moms back to paintings earlier than they were 18 months vintage, however now not whilst fathers were particularly involved in baby care.

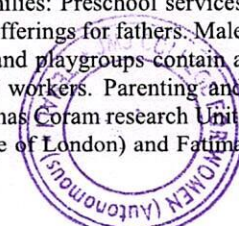
■ paternal employment: Fathers in Britain have a tendency to paintings an awful lot longer hours than their ecu counterparts. Cutting-edge couples keep to stand the predicament that they could most effective decorate their own family price range through work on the fee of decreased involvement in child care.

■ Father's impact on baby development: research with more youthful children suggests that mother-toddler relationships commonly have an effect on children's improvement extra than father-infant relationships. But studies of subsequent attainment recommend that fathers' 'inputs' are constantly linked to measures of kids's development once they enter secondary college, in contrast to those of moms. There also are constant institutions among father-teenager relationships and a younger individual's adjustment to adult existence.

■ Cohabitation and fathering: Cohabiting relationships can range from mutual commitment to a shared assumption that the relationship will now not final. Studies recommend that even when much less steady relationships dissolve, there is usually a dedication to maintain father-infant relationships, until there was a records of violence.

■ Ethnic minority fathering: there has been sizeable speculation approximately fathering among minority ethnic agencies within the United Kingdom, but care is wanted to interpret records in context. in the US, commentators have made sweeping statements approximately nonresident African American fathers which more cautious studies has eventually showed to be unfounded.

■ Fathers in unique circumstances: research have paid particular attention to susceptible corporations for whom centered social policy interventions can be suitable, inclusive of: – Teenage fathers: A latest united kingdom have a look at observed 60 in step with cent of younger fathers in Bristol remained enormously involved with their children. – Professional services for families: Preschool services for families seldom provide offerings for fathers. Male employees at day nurseries and playgroups contain a tiny percentage of group of workers. Parenting and ethnicity Ann Phoenix (Thomas Coram research Unit, Institute of education, college of London) and Fatima



Husain (Centre for financial and Social Inclusion) policy-makers, practitioners and lecturers have long viewed 'race' as an essential issue affecting the parenting children get hold of. but, variations of 'race' were handled simplistically and there was an inclination to make assumptions about parenting in minority ethnic organizations on the idea of a few research along with little, or insufficient, information. The overview highlights British research wherein to be had and a much larger frame of yank studies.

- a few studies evaluate minority and majority ethnic agencies with an implicit assumption that the majority ethnic organization constitutes the 'norm' towards which different households are (frequently unfavourably) compared.

- Simplistic assumptions about parenting are every now and then shared by means of individuals of minority as well as majority ethnic companies. for instance, one uk examine located that Asian, black and white dad and mom frequently taken into consideration that they had few practices or values in not unusual. Many Asian and black dad and mom believed that white parents lacked commitment to parenting, and that white children had been undisciplined and missing recognize for his or her mother and father.

- Many research of parenting fashion and baby consequences have concluded that a aggregate of parental responsiveness and behavioural manage called 'authoritative' parenting is most appropriate to a greater 'authoritarian' style. however, those findings had been known as into query in latest years on the subject of ethnicity, and additionally social magnificence and gender.

- intended 'traditional' developments in the circle of relatives practices of minorities can be the end result of edition to unique circumstances. particularly high tiers of employment amongst black British mothers, as an example, not most effective relate to ancient and cultural elements but also structural and economic factors.

- Researchers and practitioners disagree about the region of 'race' in mother and father' use of physical discipline and its impact on children's development. but assumptions about bodily field in black and minority ethnic communities may have unfortunate outcomes. inside the case of Victoria Climbié, an understanding that it become 'culturally appropriate' to punish kids critically contributed to the failure to understand toddler abuse.

- A preoccupation in studies with the effects of 'father absence' on youngsters – with particular connection with African American and African Caribbean fathers – has resulted in little interest being given to fatherhood among ethnic agencies in widespread.

- The belief that fathers are without a doubt 'absent' from their youngsters's lives if they're nonresident can not be assumed. One look at of British black families identified a number approaches that non-resident fathers contributed to their kid's lives, so that some have been now not taken into consideration 'absent'.

- Religion stays an understudied issue of circle of relative's lifestyles. Religiosity has been related to protecting elements that make stronger households, but little information is currently to be had at the useful or dangerous roles that faith performs within the domestic.

- Studies demonstrates that racial discrimination and abuse effect on everyday practices of parenting, now not least due to the fact parents attempt to guard their kids from racism. particular research know-how of the approaches in which racism affects children and parenting continues to be constrained. Parenting in blended historical past families has acquired restricted attention regardless of evidence that their children of mixed parentage may also face bad 'racialization' via spouse and children on both aspects of their family. it is increasingly more clean that children from special blended backgrounds fare otherwise.

- relying on simple differences among 'black', 'white' and 'Asian' households is not good enough in research analyses whilst looking for right understandings of social trends. it is also essential to understand the outcomes of 'race', ethnicity, magnificence and gender and the ways they intersect with every different.

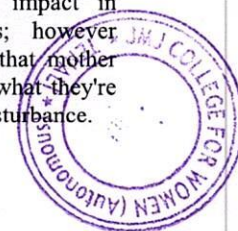
- A key challenge for future research into ethnic and combined-history parenting will be to region their meanings in context for exceptional households in phrases of socio-financial status and social exclusion.

## V. CHILDREN'S VIEWS AND EXPERIENCES OF PARENTING NICOLA MADGE

The focus of this evaluate is studies with children rather than research approximately children. based totally on an examination of the literature, consultations with professionals in the field, and two awareness businesses with young people, it explores youngsters's money owed of parenting where 'brought price' is received from inclusive of their perspectives. The assessment concludes that:

- Gaining youngsters's views significantly will increase understanding of the parenting process. What young human beings 'suppose' is not necessarily what adults 'think they think'. mother and father have a tendency to underestimate their own impact in comparison with friends and friends; however youngsters's money owed also suggest that mother and father frequently fail to understand what they're going via at times of serious emotional disturbance.

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## STUDENTS' MOTIVATION IN ENGLISH LANGUAGE LEARNING

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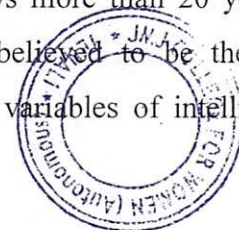
### ABSTRACT

This article outlines the socio-psychological aspect of EL students and the role of motivation as a significant factor in learning a second language. The researcher centers around motivation a contributing component in second language procurement, especially on Gardner's idea of instrumental and integrative motivations of students. Motivation refers to the combination of effort and desire to achieve the goal of learning the language and desirable approaches towards learning the language. It also explains reviews of previous research, objectives, and different kinds of motivation, distinctiveness of motivated students, implications and

**Keywords: Motivation, language learning, English language, implications**

### INTRODUCTION

The objectives of any second language program are partly linguistic and somewhat nonlinguistic. The linguistic aims centers around creating capability in the person's capacity to read, compose, talk and comprehend the second language. Non-semantic objectives accentuate such viewpoints as improved comprehension of the other network, want to keep concentrating the language, underlying foundations of the craving to get familiar with the subsequent language, an enthusiasm for learning different dialects, and so forth. In second language learning, various language student inspiration models have been proposed. Carrol and Sapon (1959) created MLAT or the Modern Language Aptitude Test to measure language learning ability utilizing an integrative testing design to choose students for language practice programs. Works by Clement, Gardner, and Smythe (1977), Dornyei (2001), Ushioda (2003), MacIntyre, Dornyei, Clement, and Noels (1998) are most known by others. (Gardner et al., 1974) model is considered as one of the most influential in second language learning. Its progress follows more than 20 years of research. The model brings four individual variations which are believed to be the most influential factors in second language learning. These comprise the variables of intelligence,



language aptitude, motivation and situational anxiety (Giles, Coupland, & Coupland, 1991). In the model, motivation is perceived to be composed of three elements-include effort, desire and affect. Effort refers to the time spent studying the language and the drive of the learner. Desire designates how much the learner wants to become proficient in the language, and affect illustrates the learner's emotional reactions with regard to language study (Gardner, 1982).

The communal and cultural milieu is one of the four interrelated highlights of the model. The social or cultural milieu alludes to the earth wherein an individual is arranged, in this way deciding their convictions about different societies and language. The creation of the Attitude/Motivation Test Battery fluctuates to some degree from structure to shape contingent on the reason for which it is proposed (Gardner, 1982).

Providing learners with a student-centered, less-anxiety classroom atmosphere has a great impact on language attainment. Personalizing the surroundings can relax the students and enhance the friendly atmosphere, which will increase their desire to learn and develop their language skills. Learners who feel safe and comfortable would feel more safe taking chances; they would show greater motivation to read aloud in a class or write an essay without any fear of being criticized.

Students can achieve success by setting their own objectives and by directing their studies toward their own expectations. Learners can help themselves achieve their goals by determining their own language needs and by defining why they want to learn the language. The motivation of the students increases when they have high goals and expectations. Teachers need to encourage the students to have specific short-term goals such as communicating with English speakers or reading books in English and help them to achieve the goals.

### **The objectives of the study**

- ❖ To discover the basis of motivation or reason for second language (L2) learning
- ❖ To assess the nature of the motivation
- ❖ To propose essential alterations in the program, content and teacher conduct to increase and to maintain students motivation

### **Reviews of Previous Research**

Investigators have different views about students' motivation. Lucas (2010) said that learners are intrinsically motivated to learn speaking and reading skills and are also fundamentally motivated through knowledge and achievement. According to Guthrie (1997), intrinsic motivation has a



significant impact not only on reading comprehension but on the other aspects of reading such as reading breadth. Tercanlioglu (2001) stated that Turkish learners have positive attitudes towards reading because they read both for intrinsic and extrinsic motives.

According to Dital (2012), students were highly motivated with positive attitudes towards learning English. They were both instrumentally and integratively motivated. Chang (2010) expressed that class group impacted learners' motivation and they felt relaxed with the motivated classmates. Moskovsy and Alrabai (2009) said that instrumental motivation plays more important role than the integrative motivation in EFL learning. The other result of this study indicated that integrative motivation is more pertinent to ESL learning.

### **The Motivation in Second Language Learning**

Motivation is usually described as the mental quality that leads individuals to accomplish a goal. For language students, proficiency of a language might be a goal. For Gardner et al. (1974) inspiration comes from attitude and this thought is developed from a subject's responses to various questions. Gardner et al. (1974) separates the motivation in two kinds that depends on upon various kinds of attitudes.

### **Kinds of Motivation**

Motivation is described as the student's direction to achieve the goal of learning a second language. It is divided into two essential types: integrative and instrumental.

### **Integrative Motivation**

The student's direction with respect to the objective of learning a second language implies that student's uplifting frames of mind towards the objective language gathering and the longing to incorporate into the objective language network (Crookes and Schmidt, 1991).

### **Instrumental Motivation**

The student's desire to acquire something practical or concrete from the study of a second language underscores his/her Instrumental inspiration. The direction underlies the objective to increase some social or monetary reward through L2 achievement (Hudson, 1999).

### **Distinctiveness of motivated students**

The creator of a classic study of successful language learning arrived at a conclusion that most thriving students are not necessarily those to whom a language comes effectively; they are those who show certain distinctive characteristics that are mostly associated with motivation.

- ❖ Positive mission direction





- ❖ Ego participation
- ❖ Necessity for accomplishment
- ❖ High ambitions
- ❖ Goal direction
- ❖ Determination
- ❖ Tolerance of uncertainty

### **Key Factors of Motivation**

In understanding the socio-instructive model, motivation to acquire the second language incorporates three components (Gardner and Lambert, 1972):

- a) The motivated individual consumes effort to acquire the language.
- b) The motivated individual enjoys the task of learning the language
- c) The motivated individual wants to accomplish a goal

### **Implications**

Researchers opinion that English teaching and learning centers should reshape the programme, course activities, practice in and outside the classroom keeping in mind the interest and need of the learners and industry need.

- ❖ A close network of English language students and English language centers need to be formed and that has to be well connected nationally and globally.
- ❖ Course content and exercises ought to be formulated on instrumental direction for the individuals who have instrumental motivation for English learning
- ❖ One has to be dependent not only on instrumental motivation for progress of the institute but also to integrative one.
- ❖ Language teachers need to be empowered through seminars, workshops, conferences, faculty development programmes and so on. so that they can enhance the motivation of the learners.
- ❖ Inorder to improve the learners' integrative motivation, the learners must be exposed to different places to learn the language of other places.
- ❖ The teachers need to create opportunities for the students to visit, participate in competitions, sharing, student seminars with other English language learners of various countries and also abroad.



## CONCLUSION

Motivation plays a key role in learning a second language. The core of motivation is passion and desire to achieve the goal. Students need quality training, input, interaction, and opportunities to make progress and to acquire proficiency in English language. Teachers can play very essential role in motivating the students to learn the language taking into consideration of their interest and expectations. It is a great challenge to maintain language learners' motivation at a high level all the time. However, teachers need to influence students' motivation as it is the most essential thing to acquire a second language and provide ample opportunities to expose themselves to different places to learn the language.

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## SIGNIFICANCE OF ENGLISH LANGUAGE IN PRESENT-DAY WORLD

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### ABSTRACT

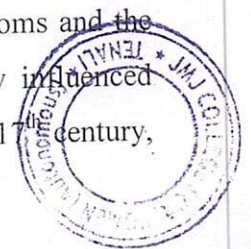
Language is important to make communication and the most influencing language for the communication is English. Communication is important to express our views, thoughts and expression. Communication might be verbal or non-verbal depending on the consideration. Animals uses communications in a non-verbal like postures, gestures etc. in order to express their views and feelings. But, human being uses language to communicate with each other. The main aim of learning any language is to communicate with people. Language consists of grammar and a set of sounds and written symbols that are used for speech and writing. In the present era, communication plays the key role for all round development of individual or organization or country to share their knowledge. The exchange of information from sender to recipient must be proper to get the desired outcome i.e mutual understanding. English language is considered as global language to communicate with the people all over the world. Hence, this article focuses on the importance of English language in this competent world.

**Keywords: English language, communication, global language**

### INTRODUCTION

English is the global language speaks throughout the world. English is mother language spoken by people in several countries. In the entire world, people consider English as a Second Language to develop in the professional fields like Engineering, Medical, Aeronautics, Lecturers, and Lawyers etc. In order to get knowledge from the expertise in a particular profession, we need to interact with those people through English language to enhance our subject knowledge.

England and South eastern part of Scotland was ruled by the Anglo-Saxon kingdoms and the medium of language is used English to communicate with each other. It slowly influenced United Kingdom & Great Britain. When the British ruled the entire world in the 17<sup>th</sup> century,



English language spread and propagated in the British rule colonial countries and as a result English spread all over the world. The United States & Great Britain have good international relations & political affairs for the past few decades and accepted that English is the primary language spoken in several countries. English is important in many countries in the fields of Diplomats and higher officials. They will understand and grasp the profound knowledge in the international affairs in diplomacy.

In the globalised & interconnected world, English is the major language for immigrants who came to USA to communicate with the local people. Thus, English is considered as the second language for communication by many countries in the world. A person who has profound knowledge in English language has great job opportunities. Many institutions & multilateral agencies from different countries like Geneva, Vienna, and Hague & New York recruit multilingual-skilled professionals. Commonwealth Nations offer numerous employment opportunities to the people who can understand & communicate well in English. Tourists from Great Britain, Australia & the United States selected English as a first language.

### **Review of Literature**

In the present society, technologies play a very vital role in the science and knowledge development and English is used as the instruction medium, public are obligated to master English language to use technologies effectively. Internet is widely used by the people to share ideas and knowledge. An evaluation showed that in internet, more than 80% of the sites use English as the medium language while 20% of the rest use various tongues such as Indonesian, Chinese, and the others (Alfitri, 2012). It shows that if people don't learn English as their second language they will obtain less than 20% of the new knowledge as current knowledge is generally shared through the web.

Mujiyanto et al (2010:2) traces culture as the unavoidable outcome of human endeavor to keep up their life, keep up their bloodline, and to lift their affluence. Mujiyanto et al (2010:5-6) clarifies that culture is separated into two social affair; they are high culture and low culture. A society is measured as highly cultured when the citizens have wide reading habit, tend to write, devote themselves to the knowledge development, comprehend their health value etc. The distinctiveness of low cultured people is that they tend to listen, watch, and speak and they don't really concern on the development of knowledge, they do not actually understand about their



health value etc. Language takes an essential role in cultural development and English as a high culture language, it contributes in learning the culture of the people and to understand the value of healthy and high cultured life.

Sneddon, (2003), states as a worldwide language, it is clear that English plays a significant role in the global communication. The Communication includes financial relationship among countries, international business relationship, global business etc. In this sort of global communications, English chiefly acts as a worldwide used language.

### **Importance of English**

In the day-to-day life, English plays a crucial role and vast utility in the present world. So, the use of English would be continued besides Hindi and many regional languages mainly for the following purposes;

- a) **In Business:** English is broadly used by the international business community to communicate over international borders & sustain correspondence with the business parties.
- b) **In Education:** English is important for specialized training & higher education. Many books on list of subjects are written in English. In education, English is used as a medium of instruction for higher education.
- c) **For Getting Job:** For achieving a good job, English is considered as important. Even Multinational companies and international corporations ask people who have better command over English language.
- d) **For Information:** In the present world, information is a great way and English is necessary to access any information. Most of the information is available in English language only.
- e) **In Media & Entertainment:** English is central for access to Entertainment & World media. The channels of satellite across the world broadcast news & views in English. Sports & Games are telecast commentaries in English. Cartoons, media productions & cinemas are available in English language.
- f) **English language is used as official language:** The elimination of English will greatly impact on the office work as English is considered as professional language for communication in the office. So if the office employees do not master English language, they will face a big problem.
- g) **For International Relation:** English is considered as an important for international relations & communications. It is mainly used in international politics, conferences and negotiations.



**Four Reasons to understand the Importance of English**

1. English may not be the most spoken language in the world, but it is the official language in a large number of countries. It is estimated that the number of people in the world that use English to communicate on a regular basis is 2 billion.
2. English is dominant language in business and it becomes necessity for the people to communicate in English if they want to enter into global workforce, research etc. Learning English can really change the life style of the people.
3. Most of the world's top films, books and music are published & produced in English. Hence, by learning English one can access great wealth of entertainment and better cultural understanding.
4. 50% of the content produced on the internet is in English. Therefore, knowing English can help the people to attain more knowledge about the world.

**Importance of Learning English Language**

Language is the medium through which a person communicates his/her feelings & thoughts to the other person. It is a tool, which he/she conducts his/her business in the society. It is a medium, through which different subject matters are transferred.

A person must know something of the structure of his language, its position in the world and its relation to other tongues. A language lives in a society as long as people speak it and use it as their native tongue. A language is important because the people who speak it are important politically, socially, commercially, economically and culturally. Importance of English language is doubtlessly great. It is spoken by more than 340 million people as a first language in United Kingdom and the United States. English is widely used as an international language throughout the world. It is one of the official languages, even in most of the countries of the third world. It is also used for international communication. English is the highly developed language which has the ability to express ideas and it is the means of revelation of modern civilization.

Importance of English language is due to its international use. It is a fact that a vast knowledge of the universe has been demonstrated in this language. For the achievement of that knowledge, it is essential to understand this international language. We may assume that it shares with the other highly developed languages of Europe the ability to express the multiple ideas & thoughts which express in the present modern era.



In this present scenario, electronic media has extensively spread throughout the world, so it is necessary to learn English language as it is the medium of communication and those who do not acquire the language will not obtain the world knowledge. English has proved itself, as a torch-bearing to the nations of the third world. It is considered as the means of enhancing knowledge.

#### Four Skills of English Language

English has four skills that are listening, speaking, writing and reading. Our Indian curriculum in educational institutions would help the students mostly with reading and writing and our students lack behind learning speaking and listening. When students come to TOEFL or IELTS, they do not pass in speaking and listening skills. Acquiring speaking and listening skills are very essential for the students to pass the tests like TOEFL or IELTS to apply for abroad universities after graduation or working in industry where English is mainly used. Hence, learning English skills is very important as it is used in various fields and specially to get better jobs and opportunities abroad.

#### CONCLUSION

English language plays an essential role not only for international communication but also get a bright future. People are considered qualified if they are able to speak in English. Moreover, English has also been one of the prerequisites in the job-fields, especially in the higher positions. In this competitive world, people are urged to acquire English language to communicate globally. By mastering English language people will be able to attain more knowledge and information. Therefore, it is very important for us to acquire English language as it connect us with global life.

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# NATIONAL POLICES AND THE ACTS FOR THE SENIOR CITIZEN IN INDIA

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**Abstract:** India is the seventh largest country within the global and the besides the population it's far inside the 2nd place. Here in this paper the inevitable and irreversible demographic virtualization has been described. About the health concerns, seclusion and the meals habitation Loss of Spouse and Living Arrangements. The predominant Objectives of this paper are National polices for Health Insurance for Senior Citizens, Policy Response to Ageing in India, Income Insecurity and Compulsion to Work, Urban upper and middle earnings elderly and Elderly living alone.

## I. INTRODUCTION

### Population Ageing in the World, 2012–2050

Population ageing is an inevitable and irreversible demographic reality this is related to welcome improvements in health and clinical care. With longevity and declining fertility rates, the population of older persons (60 years and above) is globally growing quicker than the general population. When populations age rapidly, governments are often stuck unprepared to face and mitigate the consequences; this has implications for the socio-monetary and health popularity of the elderly. Three key demographic changes—declining fertility, discount in mortality and increasing survival at older ages—make a contribution to population getting older, reflected in a shift within the age structure from young to vintage. The demographic transition method of declining fertility and mortality gives rise to growing bulge in older cohorts, in comparison to younger cohorts. The vintage-age dependency in the populace therefore gradually increases. The shift from a period of high mortality, quick lives, and big families to one with a longer life, far and fewer children is the hallmark of demographic transition. A top-heavy age structure means that the aged need to depend upon incomes and sales generated via a dwindling number of younger workers.

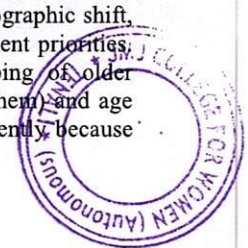
In general, growing older is described in phrases of chronological age with reduce off age of 60 or 65 years.

This definition is partly because of the fact that retirement age is also similar to this cut off age.

However, in many growing international locations, chronological age may also have very little relevance to retirement as majority of the elderly are engaged in informal sector with no specific retirement age. In such cases, the socially constructed meanings of age are more frequently significant, such as the roles assigned to older people or loss of positive roles that signify physical decline in old age.<sup>1</sup>

Globally, the 60-plus population constitutes about 11.5 percent of the total populace of 7 billion. By 2050, this proportion is projected to boom to approximately 22 percent when the elderly will outnumber kids (below 15 years of age). The elderly represent the fastest growing age segment at the same time as the children and working age segments lessen gradually (Figure 1.1). In some regions and nations, the share of the elderly is however developing quicker than the worldwide average. In evolved international locations, the share of the aged will boom from 22.4 percent in 2012 to 31.9 percentage in 2050. This percentage is anticipated to extra than double in less advanced international locations with an boom from 9.9 percentage in 2012 to 20.2 percent in 2050. In least evolved international locations, the percentage of the elderly in 2050 is projected to be beneath 11 percent.

Thus, in some developing international locations, the vintage-age dependency rate could greater than double in 50 years, a phenomenon that become stretched over 150–two hundred years in tons of the advanced world. The rapid growing old of developing nations isn't always observed by the will increase in non-public incomes witnessed in the developed world during its getting old manner. Further, the governments of the rapidly growing old growing countries are slower in recognizing and responding to the demographic shift, largely because of competing development priorities. Countering ageism (the bad stereotyping of older people and prejudice in opposition to them) and age discrimination (treating someone differently, because



of their age) is a delivered issue.

In Asia as a whole, the share of the aged is expected to grow from 10.5 percent to 22.4 percent at some point of 2012–2050. In East Asia, the percentage of the aged is predicted to be 34.5 percent by means of 2050. Japan (41.5 percent), South Korea (38.9 percent), China (34 percent) might also be anticipated to record the best proportions of the elderly population inside the region by means of 2050. The South Asian Association for Regional Cooperation (SAARC) international locations, however, are probable to have handiest approximately 21 percent population above 60 years with the aid of 2050. Within the SAARC, Bangladesh (22.4 percent), Bhutan (24.1 percent), Maldives (31.2 percent) and Sri Lanka (27.4 percent) are anticipated to overshoot the SAARC common for the statistic via 2050. While India is not expected to document extra than 19 percent elderly by 2050, the absolute numbers can be very large.<sup>3</sup>

## II. India's Elderly: Levels and Trends

The percentage of the elderly in India has been increasing at an increasing rate in recent years and the trend is likely to continue in the coming decades. The share of population over the age of 60 is projected to increase from 8 percent in 2015 to 19 percent in 2050 (Figure 1.2). By the end of the century, the elderly will constitute nearly 34 percent of the total population in the country. Though the growth rate of the elderly population dipped slightly in the 1960s and 1980s, it was always greater than the general population and the difference between the two has widened over the period. Figure 1.3 presents the size and growth of the elderly population in India between 1950–2100. The figure shows that annual growth rate of the elderly will be over 3 percent till middle of this century indicating faster pace of growth than other age categories. On the contrary, the growth rate of younger age group is already negative in the country.

Undoubtedly, therefore, relatively young India today will turn into a rapidly ageing society in the coming decades. A distinguishing feature of ageing in India is the significant interstate disparity in terms of both levels and growth of the elderly population depending upon the pace of demographic transition in these states.

## III. Differentials across States

India has significant interregional and interstate demographic diversity based on the stage of demographic transition, variations in the onset and pace of fertility transition. Consequently, there are

considerable variations in the age structure of the population, including the ageing experience. For instance, the southern states are the front runners in population ageing along with Himachal Pradesh, Maharashtra, Odisha and Punjab (Figure 1.4). The central and northern states such as Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh and Uttara khand have much lower proportions of aged population. Based on 2011 Census, the overall old-age dependency ratio shows that there are over 14 elderly per 100 working age population, with significant variations across states. In Kerala, Goa, Punjab, Himachal Pradesh, Tamil Nadu, Maharashtra, Odisha, Telangana and Andhra Pradesh, the old age dependency ratio is higher than 15 (nearly 20 percent in Kerala) whereas it is less than 10 in Arunachal Pradesh, Meghalaya, Nagaland and Chandigarh. Higher old-age dependency reflects higher level of demand for care from immediate family.

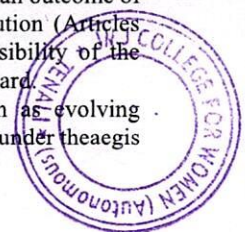
The mortality experience among general population as against the elderly population contributes to the faster growth of the latter group. According to data from the Sample Registration System (SRS), life expectancy at the age of 60 has increased from 14 years in 1970–1975 to 18 years in 2010–2014 with women living about two years longer than men (Figure 1.5). All the Indian states show a life expectancy at 60 of over 15 years currently except males in Chhattisgarh. Thus life expectancy improvement has been substantial in most states of India. Currently all the states have higher life expectancies at old ages for women than for men.

## IV. Challenges of an Ageing Population

As already pointed out, population ageing in any country creates its own challenges and opportunities as well. Four aspects of ageing are particularly appropriate for India.

## V. Policy Response to Ageing in India

The Indian government's commitment to population ageing concerns is evident in two important ways: (a) being a signatory to all the global conferences, initiatives on ageing as well as the Regional Plans of Action; and (b) formulation of the National Policy on Older Persons (NPOP) in 1999, well ahead of Madrid International Plan of Action on Ageing (MIPAA), the United Nation (UN) sponsored International Plan of Action. The National Social Assistance Program for the poor is also an outcome of the Directive Principles of our Constitution (Articles 41–42) recognizing concurrent responsibility of the central and state governments in this regard. India's national response can be seen as evolving along with many multilateral initiatives under the aegis



of the UN which spearheaded global attention while encouraging country action to address ageing concerns. The projection scenarios produced by the UN and the attentive ear lent to the voices of elderly men and women contributed to better understanding and clarity on ageing issues. The government also recognized that some of the key concerns of our senior citizens could be best addressed only in partnership with non-governmental organizations (NGOs). India's association with incremental global understanding of ageing issues has been significant—starting from the 1982 Vienna International Plan of Action on Ageing, followed in 1991 by the development of 18 principles for older persons (grouped under five quality-of-life attributes: independence, participation, care, self-fulfilment and dignity) and then the Second World

Assembly on Ageing held in Madrid in 2002. As mentioned above, the NPOP formulation in India preceded MIPAA with the aid of approximately three years and has in some approaches stimulated the Madrid Action Plan. India also shared with other countries and international NGOs the critical lack of interest to growing old in the Millennium Development Goals (MDGs). The post-2015 development goals referred to as the Sustainable Development Goals (SDGs) in widespread and SDG-3 in particular has given interest to getting old. In the most recent 2016 UN General Assembly, India further ratified its dedication to SDGs and reported streamlining them into countrywide development indicators. Indian coverage reaction to getting older has also won from the work of the World Health Organization (WHO) on Active Ageing, the Convention on the Elimination of All Forms of Discrimination towards Women (CEDAW) resolution of January 2010 on older women, the United Nations Population Fund (UNFPA) paintings on social-economic implications of getting old thru the initiative Building a Knowledge-base on Population Ageing in India (BKPAI), the paintings of the International Labor Organization (ILO) on income safety and social pensions in addition to the large records collection efforts under Longitudinal Ageing Study in India (LASI) and Study of Global Ageing and Adult Health (SAGE).

#### VI. Indian Elderly: Status and Concerns

As discussed in Chapter 1, the increasing percentage of the 60-plus population in India at the side of realization and feminization of growing older has posed several demanding situations for the U.S.A., the growth in vintage-age dependency ratio being of instantaneous challenge. The elderly have special financial, physical, emotional and scientific needs

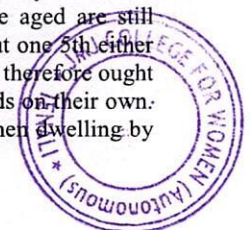
which must be supported decade on decade via a shrinking percentage of operating age folks.

In this bankruptcy discusses the popularity of the older folks in India with recognize to loss of spouse and living arrangements, earnings lack of confidence and paintings, fitness and social protection. The chapter also highlights positive issues in the context of gender and outreach of social protection schemes which are mainly meant for the elderly. The chapter is mainly based on the statistics from numerous National Sample Survey Office (NSSO) Rounds, Census of India, the National Family Health Survey (NFHS) and the Building a Knowledge Base on Population Ageing in India (BKPAI) project, a 2011 UNFPA-funded, seven-nation initiative.

#### A. Loss of Spouse and Living Arrangements

Loss of partner in vintage age provides sizable vulnerability in later years. Since widowhood adds vulnerability during vintage age, expertise the percentage of widows among older persons in a society gives a far clearer photograph approximately the popularity of older folks. The 2011 Census suggests that almost sixty six percentage of these over 60 years of age are currently married, 32 percent are widowed and nearly 3 percentage are separated or divorced<sup>13</sup>. The marital status distribution of elderly men is extensively one-of-a-kind from ladies given that 82 percentage of older guys (compared to 50 percent of older women) are currently married. The share of these who've lost their spouse is plenty higher among ladies compared to guys with 48 percentage of older girls and best 15 percentage of the older guys being widowed. Since women are much more likely to be dependent on guys for economic safety, ladies face extra adversities due to loss of partner as compared to men.

The properly-being of older people also can greatly depend on whom they live with, mainly in growing international locations wherein the elderly have little recourse to formal welfare systems. Living arrangements most of the aged turned into not an issue in India till some a long time ago due to the fact their families have been expected to take care of them. But with the discount in fertility and increased existence expectancy at antique ages, conventional living arrangements were present process transformation. With declining informal social assist structures, older folks who live alone are probable to be more prone than those who live with the family, mainly in the case of aged ladies. While majority of the aged are still dwelling with their kids in India, about one fifth either stay alone or only with the partner and therefore ought to manage their fabric and bodily needs on their own. The proportion of older men and women dwelling by



myself without spouse (solo living) has increased over time from 2.4 percent in 1992/ninety three to 5 percent in 2004/05.

The percentage of elderly who live alone numerous from 13.7 percent in Tamil Nadu to 1.7 percent in Jammu and Kashmir in 2005/06 (Figure 2.1). Similarly, survey data from the BKPAI accrued in 2011 also showed that the percentage of the aged residing by myself was the highest in Tamil Nadu (26 percent). Across the seven states, a better percent of aged girls live on my own compared to men. As expected, greater elderly who've misplaced their spouses stay by myself (Figure 2.2).

### **B. Income Insecurity and Compulsion to Work**

Income insecurity is one of the principal causes of vulnerability in antique age. In India, it is normative for households to attend to the needs of older individuals, such as financial and social wishes. With the converting socio-financial, demographic and improvement scenario, monetary safety arising from personal income and asset ownership has end up a main determinant of properly-being of older humans. However, if profits normally accrues from their work, it's miles very likely that their dependence on paintings will increase with age. The BKPAI survey statistics shows that 26 percent of older guys and around 60 percent of older ladies do not have any personal earnings. About one 1/3 of the older males and females get hold of earnings from employers or social pensions (Figure 2.3). The essential source of profits particularly for older guys is still income or wages. This indicates that older men paintings to aid themselves even during vintage age.

Although round 50 percent of the elderly have a few sort of personal income, the income earned by means of the aged is not enough to fulfil their basic desires and therefore they're financially dependent on others. Almost 3 fourth of the aged are either completely or partially dependent on others, and such dependency is more for aged women than guys.

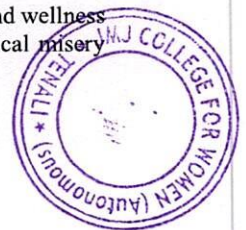
Financial dependency additionally will increase with age. Elderly individuals in India no longer handiest work to assist themselves but also make financial contributions to their households. About 70 percent of older guys and 36 percent older ladies perceived that they contributed to household expenditure. More than half of the elderly men perceived that their contribution covered extra than 60 percent to the family budget (Figure 2.four). Overall, it seems that elderly nevertheless depend substantially on their income to aid themselves and their family.

Work participation inside the older ages has distinct connotations. If older folks training session of their own desire and no longer due to financial constraints there is a more superb connotation to work. But if this is due to financial compulsions, it indicates a extra degree of vulnerability for the worker. The NSSO anticipated that in 2012/thirteen, 34 percent of older persons have been working<sup>16</sup>. Although the paintings participation charge declines with age, data suggests that 18 percent of adult males and three percent of girls paintings past age 80 years. The work participation fee according to social organization additionally indicates that a significantly higher proportion of elderly belonging to scheduled castes/scheduled tribes work than different caste groups (Figure 2.five).

The currently carried out BKPAI statistics also display that aged work participation is a great deal higher among poor and less educated people indicating that poverty is an essential reason for elderly work participation. The BKPAI collected information on compulsion to paintings, and confirmed that 71 percent of the aged paintings due to monetary compulsion and extra so within the case of elderly girls (82 percent) than guys (68 percent). The occupational structure also truly suggests that aged are normally engaged in unskilled, casual, low paying occupations like agricultural labor and petty trades wherein they do no longer receive any post-retirement advantages nor have any retirement a specified within the first place. The elderly paintings participation price additionally varies throughout the states of India with highest work participation charge in Meghalaya with nearly 60 percent of the older men and women are in labor force and lowest in Goa with only 8 percent of the older people in labour pressure. Among the essential states, aged paintings participation rate is above 40 percent in Himachal Pradesh (48.8), Andhra Pradesh (40.3), Chhattisgarh (41.1) and Uttar Pradesh (41.2), while in Assam, Kerala, Haryana and West Bengal the work participation price hovers around 25 percent. A enormous percentage of the older individuals additionally work beyond age 80 particularly in states like Bihar, Madhya Pradesh, Uttar Pradesh and Jammu and Kashmir (Figure 2.6).

### **C. Health Status of the Elderly**

Health is decided by using many economic, social, psychological and physiological factors. Poor health and morbidity decrease the quality of life and wellness of the elderly even as growing psychological misery and belief of vulnerability.



### 1. Prevalence of Morbidity

When someone reports an event of illness or negative fitness for the duration of the 15 days previous to the survey, it's far recorded as an example of acute morbidity. With advancing years, the occurrence of acute and persistent morbidities will increase. As Figure 2.7 shows, in 2014, the superiority of acute morbidity accelerated from 30 percentage in the age group 60–sixty nine years to 37 percentage for the 80-plus organization. Further, it became marginally higher among ladies than men.

Severe morbidities require hospitalization; no longer surprisingly, the estimates of NSSO 71st Round, 2014 imply that the charge of hospitalization amongst aged is a good deal better than the overall populace. Furthermore, even as the morbidity occurrence fee is better among aged girls, their hospitalization charge is decrease than the men indicating gender differentials in fitness care.

Estimates based totally on BKPAI facts show that of the aged hospitalized, forty seven percent were admitted to authorities hospitals and the relaxation availed of personal facilities. Preference for personal centers become more seen in urban regions than rural. The price of the health care at some point of antique age seems to be very excessive and this in turn increases the out of pocket expenditure on health care in particular when private facilities are availed of. Out of the full expenditure, almost half of of the expenditure was in the direction of medicines. Treatment value for continual morbidities is likewise pretty excessive. When older people are economically established, growing health expenditure provides to the monetary burden on the family.

### 2. Non-communicable Diseases

Chronic sicknesses are a leading cause of death amongst elderly in India, increasingly more so over the last 25 years. The percentage of aged with any chronic situation as predicted via SAGE, Wave 1 became 41.8 percentage in 2007. The same discern as consistent with the estimates of BKPAI changed into 64.8 percentage in 2011. Chronic ailments are more regularly occurring among aged women (674 according to 1,000) than aged men (619 consistent with 1,000) as also higher in rural areas (658 out of 1,000) than urban (621 out of 1,000). Common chronic ailments inclusive of arthritis, hypertension, cataract and diabetes are greater widespread amongst women while ailments like allergies and coronary heart disease are extra customary in men. There are also variations in the prevalence of various continual diseases throughout states of India. Out of the seven states surveyed, the prevalence of arthritis among elderly is found to be better in Punjab (478 in keeping

with 1,000) accompanied by way of Himachal Pradesh (390 in step with 1,000) and Maharashtra (351 in step with 1,000 at the same time as for different persistent illnesses, occurrence costs are better in Kerala. For remedy of chronic illnesses within last three months, most of the elderly have preferred private hospitals over government health facilities with attendant escalations in price. 22

### 3. Self-perceived Health

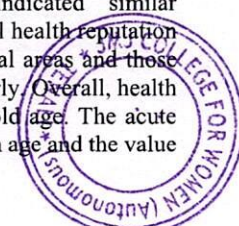
Self-rated fitness is an vital overall indicator of health reputation. In studies primarily based on surveys such as SAGE, LASI and BKPAI, respondents were typically asked to price their fitness on a 5-factor scale. Men tended to have better self-rated health than women and ladies had been much more likely to record terrible or fair self-rated health<sup>23</sup>. SAGE Wave 1 survey suggests that 75percent aged girls reported their cutting-edge health as slight or terrible as against 64 percentage guys.

Similarly, in step with BKPAI facts, nearly 3 fifth of women rated their health as fair or awful as compared to a touch over half the guys. Data from these surveys conducted at exclusive durations of time indicated better health perception among older guys than among older women.

### 4. Subjective Well-being

According to WHO, mental fitness issues account for 13 percentage of the worldwide burden of illnesses and is particularly common among older adults. The BKPAI survey collected statistics on popular nicely-being of older men and women via the 12-item General Health Questionnaire (GHQ) and the 9-item Subjective Well-being Inventory (SUBI). The fundamental scope of the GHQ is to quantify subjective well-being that can indicate mental health in special cultures and settings<sup>25</sup>. The SUBI is designed to measure “feelings of nicely-being or ill-being as experienced with the aid of an individual or a collection of individuals in diverse day to-day existence issues”<sup>26</sup>. The GHQ rating confirmed that half of the older folks carry some shape of psychological distress. Mental health reputation also worsened with advancing age indicating higher mental fitness vulnerabilities many of the oldest vintage.

Mental health problems have been better for girls, those who were bad and less educated. The scores based on SUBI additionally indicated similar outcomes inclusive of poorer mental health reputation for ladies, the ones who live in rural areas and those who had been older among the elderly. Overall, health related vulnerabilities are high in old age. The acute and persistent diseases increase with age and the value



of treatment imposes enormous burden within the absence of health insurance or social safety.

### 5. Disability

With the growth in age, incapacity turns into a major subject, seriously limiting functioning in daily life and therefore increasing the care-giving burden. According to the 2011 census, the disability rate was 51.8 per 1,000 for the elderly and 84.1 according to 1,000 for the 80-plus population compared to 22.1 in keeping with 1,000 of the overall population<sup>27</sup>. 80-plus women have higher tiers of disability in comparison to aged guys indicating more disadvantages (Figure 2.8).

The census collects facts on disabilities referring to visible, speech, hearing, mobility and mental fitness. The prevalence of mobility and vision-related disabilities are high amongst both males and females. Visual disabilities are more not unusual many of the elderly girls while mobility disabilities are higher for aged guys. Around 4 percent of the elderly women and men also suffer from disabilities with recognize to mental fitness (Figure 2.9).

The BKPAI survey data on using disability aids inclusive of spectacles, listening to aids, and on foot sticks shows that there may be considerable unmet need a number of the older humans. For example only 53 percentage of the older people with visible disabilities are the usage of spectacles and handiest five percentage of the elderly with hearing difficulties use hearing aids. The use of incapacity aids is likewise decrease for aged girls indicating higher unmet want among them.

### VI. National Policy on Older Persons:

The Context Enhancing human welfare through social services together with education, fitness, housing and income security is generally the principle aim of social policy. Formulation of such social policy is generally within a governmental public coverage mandate. Analysis of public coverage requires a full knowledge of the hassle that the policy is addressing, its reasons and consequences.

In this the National Policy on Older Persons (NPOP). There are four features of our ageing society that have influenced the national policy reaction in India:

(i) Feminization of getting older reflected in the sex ratio of the 60-plus populace which in line with the Census of India 2011 changed into 1,033 women in step with 1,000 men<sup>32</sup>; older girls face adverse socioeconomic differentials in terms of incomes

streams, health care and care-giving in daily living which will increase their vulnerability;

(ii) Realization of getting old reflected in the truth that 71 percent of the aged stay in rural India wherein provider shipping already faces many challenges;

(iii) Increasing eighty-plus population; oldest of the antique is the fastest growing age segment, often called the ageing of the aged;

(iv) An increasing populace of solo-living persons after loss of spouse growing the vulnerability of terrible older women with no personal income.

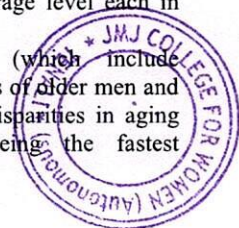
As sturdiness increases, and "70 turns into the new 60", the coverage reaction to growing older have to deal with the significant age-associated fitness care needs of all senior a long time.

The NPOP in India has been formulated as a forward-looking vision of the government for improving first-class of lifestyles of older people in India through expanded income security, fitness and nutrition, shelter, education, empowerment and welfare. The coverage makes it clear that it's miles neither feasible nor perfect for the kingdom on my own to reap the coverage goals. Individuals, families, communities and institutions of civil society and private sector have to sign up for fingers as partners. The policy views the existence cycle as a continuum, of which the post-60 segment of lifestyles is an essential part.

It does not view the age 60 as the beginning of a existence of dependency. At the equal time, the policy emphasizes the want for growing a formal and informal social support system, and strengthening the capability of households to attend to older persons so that elderly maintain to live with their own family. It aims to reinforce integration among generations and expand a bond among the young and the old and facilitate -way flows and interactions. It calls for special interest toward older women who often become sufferers of triple forget and discrimination as a result of widowhood, vintage age and gender biases. The policy encourages studies on getting old as well as advent of guides on geriatric care in medical and paramedical establishments.

1. There is an early recognition of population getting old concerns in India at the coverage level each in phrases of

2. Demographic consequences (which include increasing numbers and proportions of older men and women, shrinking support base, disparities in aging across areas, oldest vintage being the fastest



developing population segment, feminization of getting older etc.) and also

3. The quality of life of older folks (in phrases of income insecurity, distinct health care wishes of the elderly, high diploma of dependency, insufficient recognition of aged contribution to circle of relatives and community).

4. India's energetic participation in many UN sponsored global and local assemblies and conferences on growing old and more in particular the formula of NPOP in June 1999, two years ahead of the landmark UN subsidized Madrid International Plan of Action (MIPAA) in 2001 are tangible examples in this context.

5. Judging from the best coverage interventions applicable to the scenario of older men and women in India, it's far clear that a valid situation analysis have to have preceded the NPOP formula in 1999. It is also probably that the MIPAA has benefitted from a few highlights of the NPOP.

#### A. National Policy on Older Persons:

The mandate for coordinating NPOP implementation across numerous ministries of the government lies with the nodal Ministry of Social Justice and Empowerment (MOSJE). The ministry's mandate includes welfare, social justice and empowerment of disadvantaged and marginalized sections such as scheduled castes (SCs), backward classes (OBCs) people with disabilities, aged folks, transgender people as also customers of drugs and those who want to beg for sustenance. The primary goal of MOSJE is to deliver the target corporations into the mainstream of improvement by making them self-reliant and empowered (as obvious from the call of the Ministry) through its Department of Social Justice and Empowerment and the Department of Empowerment of Persons with Disabilities. The Results Framework Document (RFD) of 2014/15 of MOSJE articulates five elements of its imaginative and prescient:

(i) Social empowerment of scheduled castes (weight 50); social empowerment of different backward castes (weight 20) senior residents (weight 7); alcoholics (weight 6); and transgender people and individuals who beg for sustenance (weight 2).

The weights imply the relative precedence accorded to the prone institution via the ministry inside its overall mandate. According to the above RFD, the senior citizens mandate is one amongst five targets but receives tons an awful lot less precedence and hobby than social empowerment of SCs and OBCs. MOSJE pulled together different factors of NPOP below the National Initiative on Care of Elderly (NICE).

The four hobby clusters included within the RFD under the senior residents mandate are:

1. Integrated Programme for Older Persons (IPOP);
2. National awards for senior residents;
3. Revisions of IPOP (revised in 2008 and 2015) and
4. Method of new draft coverage on senior residents and submission to cabinet for approval.

As many as 19 unique ministries of government are worried in implementing various NPOP components, according to their respective mandates (Annexe III.1).

However, 4 ministries can be considered center as they may be responsible for a big and essential chunk of services to older people. These are:

- Ministry of Social Justice and Empowerment (MOSJE) is liable for coordination across ministries and also for imposing the critical area IPOP with the objective of enhancing the excellent of existence of senior residents by supplying basic amenities like shelter, meals, hospital treatment and enjoyment sports and by way of encouraging productive and energetic growing old. MOSJE also took the lead inside the Maintenance Act, an important legislation and is chargeable for its powerful implementation.

- Ministry of Health and Family Welfare (MOHFW) is responsible for enforcing the National Programme for Health Care of Elderly (NPHCE) thru number one, secondary and tertiary services, devoted for older people.

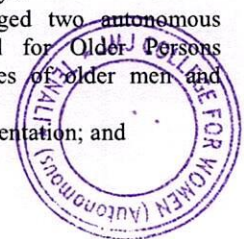
- Ministry of Rural Development (MORD) administers the National Social Assistance Programme (NSAP) underneath which vintage-age pensions and family benefits are furnished to BPL families.

- Ministry of Panchayati Raj (MOPR) is chargeable for empowerment, enablement and accountability of Panchayati Raj Institutions (PRIs) to make sure inclusive development with social justice and efficient delivery of services and participatory self-governance.

Under the Sansad Adarsh Gram Yojana (SAGY), every Member of Parliament has to undertake a Panchayat and work in the direction of convergence of various program to improve nice of existence in rural areas. When applied, this scheme will help rural aged in lots of direct and indirect ways.

- Further, the NPOP envisaged two autonomous bodies the National Council for Older Persons (NCOP) to promote the issues of older men and women

- To oversee the policy implementation; and



• The National Association of Older Persons (NAOP) to encourage participation of senior residents in issues that situation them and to lend an attentive ear to their voices. The policy additionally emphasizes the role of Panchayats and other community-primarily based agencies in effective implementation of policy intentions.

Although the onus of imposing numerous sides of NPOP lies with distinctive ministries, there are clear connections between them. This gives a scope for mainstreaming aged problems in quarter-specific plans in addition to allow their convergence at the community level for more green and effective delivery of age care offerings.

Four unique schemes/ programs with complementary objectives within the typical vision of the NPOP are covered beneath. These are:

- (i) Maintenance Act 2007;
- (ii) IPOP;
- (iii) NPHCE; and
- (iv) National Social Assistance Program.

In addition, the NPOP offers significance to the empowerment of PRIs as a key issue for improving the nice of lifestyles of the aged.

#### VIII. Maintenance Act 2007

The MOSJE championed the landmark legislation called the Maintenance and Welfare of Parents and Senior Citizens 2007, (henceforth referred as the Maintenance Act) to offer a prison frame work in help of the elderly. Parents and grandparents who are not able to hold themselves from their own income can demand renovation from their kids, inclusive of food, clothing, residence, medical attendance and treatment, to a most of ₹ 10,000 in line with month. The Act offers for a tribunal to receive and take movement on complaints. In case the children themselves do not have sufficient manner to maintain them, the country governments are expected to provide old-age homes in each district to accommodate minimal of one hundred fifty aged. An essential provision under the Act legally empowers the elderly to claim their assets returned from their youngsters if the condition of upkeep isn't satisfied. The kingdom is responsible for putting in place tribunals and no civil court will have jurisdiction on any subjects of this Act.

Sensitization of police and judiciary on safety of existence and belongings of the elderly and different provisions of this Act is likewise the duty of the nation. The powerful implementation of this Act is however, left to the states because of which there is uneven and unsatisfactory implementation<sup>36</sup>. Availability of

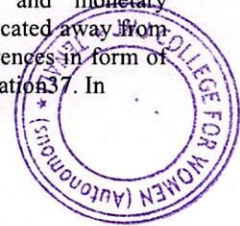
oldage homes for destitute older people as properly as provision for geriatric care, care gadgets and other concessions in government-aided hospitals as per the Act are also hassle regions. There have been no campaigns to educate the aged or deter adult children from neglecting their parents; such campaigns are important to create social strain for implementing provisions of the Act. The survey indicates that attention among structured aged about then POP in fashionable and the Act particularly is quite poor. The handful of cases introduced to the tribunals demonstrates the terrible reach and usage of this Act. To review the provisions of this Act, its implementation experience and its effect on senior citizens, the MOSJE has recently set up a committee consisting of experts in those areas.

#### A. Integrated Program for Older Persons

From 1992, a great deal beforehand of the 1999 NPOP, the MOSJE has been implementing the Integrated Programme for Older Persons (IPOP) with the objective of improving the high-quality of lifestyles of senior citizens with the aid of imparting basic facilities like shelter, food, medical care and amusement opportunities and by using encouraging effective and active getting old.

The IPOP provides monetary assistance (as much as 90 percentage) to PRIs/local bodies, NGOs, educational institutions, charitable hospitals/nursing houses etc. For imposing a whole lot of facilities which includes old age homes, mobile medical devices for older persons living in rural and remoted regions, day care centers, physiotherapy clinics, provision of disability aids, going for walks helplines and counselling centers and sensitization of school and university college students to getting old troubles. Although these types of are essential ingredients of NPOP, it ought to be diagnosed that the effectiveness of the IPOP depends to a large extent on states for supporting monetary safety, health care, shelter, welfare and different desires of older individuals.

With the advent of the Maintenance Act 2007, the country governments had been anticipated to establish and keep old-age houses, initially as a minimum one in every district for a hundred and fifty older men and women. Subsequently, the IPOP were given revised in 2008. However, studies indicate that the rapid increase of antique-age homes resulted in enormous variant with recognize to intake capacity, type of accommodation, staffing patterns and monetary supply and capacity. Some homes located away from the metropolis had good sized differences in form of constructing and value of accommodation<sup>37</sup>. In





2014, the Standing Committee on Social Justice and Empowerment reviewed IPOP implementation and recommended standardization of vintage-age homes and preparation of tips for kingdom-run old age homes to make sure the protection of strict minimum standards. Following the Standing Committee guidelines of 2014, the Government of Tamil Nadu, issued a Gazette notification in February 2016 fixing Minimum Standards in Old-age Homes. This may also inspire different states to announce similar standards as call for institutional care appears to be growing. The IPOP help for old-age houses, day care centers and cellular medical devices combined with the Maintenance Act 2007 represents public policy response to the emerging growing older situation in India. Apart from old-age houses, network-primarily based NGOs for training of caregivers, awareness generation among older men and women and caregivers on self-care, preventive health care, healthful and productive ageing, intergenerational bonding etc.

Under IPOP the MOSJE also helps formation of senior citizen associations. Although the approach of working thru RRTC's is most appropriate, dealing with the massive wide variety of NGOs to which grants-in-aid is provided beneath IPOP (round 550 and expected to increase to over 700 throughout the country) implies heavy administrative paintings load, leaving little time for greater strategic thinking on improving policy effectiveness. MOSJE at the side of the erstwhile Planning Commission also supported an initiative for building authorities-NGO partnerships to foster transparency, efficiency and accountability toward inclusive boom.

#### **B. Health take care of Older Persons**

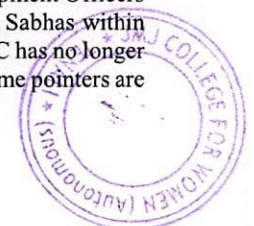
The fitness care programme for the aged is being implemented through the MOHFW from 2011 below the National Rural Health Mission (NRHM). The National Program of Health Care for Elderly (NPHCE) aims to provide devoted fitness care facilities to the elderly through number one, secondary and tertiary health care transport systems which includes district hospitals with local clinical establishments providing robust referral backup. For this purpose, the programme builds capacity of the clinical and paramedical professionals as well as own family-primarily based caretakers for imparting fitness care to the aged. It is meant to be implemented in convergence with the National Health Mission, Ministry of AYUSH38 and the MOSJE. It provides for supplies and additional staff at number one health (PHCs) and community fitness centers (CHCs), delicate 10-bedded wards at district hospitals, strengthening of the eight nearby scientific institutes

to provide dedicated tertiary-degree clinical centers for the elderly, introducing postgraduate publications in Geriatric Medicine, and in-provider training of health personnel at all degrees. Regional geriatric centers with dedicated geriatric out-patients' departments and 30-bedded geriatric wards are planned with necessary equipment together with video conferencing facility etc. Clearly, NPHCE is a very significant contribution from MOHFW closer to fitness goals of aged formulated in NPOP as well as the Maintenance Act 2007. NPHCE features underneath the control, coordination and tracking and supervision of the national, kingdom and district cells for non-communicable diseases (NCD). An exploratory examine in districts each in Odisha and Karnataka based totally on program implementation, fund launch and utilization, physical infrastructure improvement, human resources, making plans and tracking structures confirmed the real health needs being addressed by NPHCE and its value for fitness care of older persons but discovered some key bottlenecks in implementation that want to be addressed. It is thru the field realities of such schemes for the aged that national policy intentions will in the end come alive.

#### **C. National Policy for Senior Citizens**

After approximately ten years of NPOP implementation, the government formally installation a committee for review and revision. The draft revised National Policy for Senior Citizens (NPSC) changed into submitted in 2011 however still awaits cabinet approval. NPSC additionally follows a rights perspective and requires special attention on elderly women and rural terrible. It identifies profits security as a key intervention as greater than two thirds of elderly stay under poverty line. Hence the draft policy recommends a month-to-month pension of ₹ 1,000 in step with individual to be revised periodically for inflation adjustment.

It additionally requires elevated implementation of NPHCE and lays precise emphasis on support for productive ageing. In terms of implementation mechanism, the draft NPSC proposes status quo of a Department of Senior Citizens at the MOSJE and corresponding Directorates in states and union territories. Similarly, National Commission for Senior Citizens on the Centre and similar commissions on the country level are proposed as laid down inside the NPOP. At the community stage, the draft requires energetic involvement of Block Development Officers and Panchayats, urban councilor Gram Sabhas within the implementation of NPSC. The NPSC has no longer yet been officially adopted, although some pointers are being applied.



#### Health Insurance for Senior Citizens

This is visible as a logical extension of the ongoing low top class lifestyles insurance (Pradhan Mantri Jeevan Jyoti Bima Yojana), well-known insurance (Pradhan Mantri Suraksha Bima Yojana), and the pension plan (Atal Pension Yojana). It is proposed to utilize round ₹ a hundred billion of unclaimed funds underneath the Employees Provident Fund Organization (EPFO) and small savings for imparting medical insurance cover to the elderly. It is proposed to put in force this through the Department of Financial Services of the Ministry of Finance. It is proposed to hyperlink this to bank accounts of beneficiaries to directly transfer the subsidy to the accounts. The government would subsidize the premium for BPL elderly by using as much as 90 percent through direct gain transfer.

#### IX. Estimating the Demand for Elder Care Services in India

Increasing aged populace in India together with enhanced focus on fitness problems is expected to put sizeable stress on the fitness care system in trendy and geriatric care particularly. The UNFPA conducted a survey across seven states in India in 2011 to construct a know-how base on the socio-financial and fitness implications of ageing and the capacity of the elderly to get entry to and use various welfare tasks of the government.

The seven states are: Himachal Pradesh, Kerala, Maharashtra, Odisha, Punjab, Tamil Nadu and West Bengal. These states have better share of elderly (60 years and above) as a percent of population than the country wide average. The sample for every country became fixed at 1,280 aged households having at the least one elderly member. The survey showed that during 2011 around 7.6 percentage of the elderly in India (about 7.9 million humans) had difficulty in accomplishing sports of daily living (ADLs) and were in need of help. This variety is anticipated to go up extensively with advancing age.

According to the take a look at, over 5 percent of the aged inside the U.S had functionality problems necessitating regular care and support. Around 8 percentage of the elderly require assistance to perform at least one ADL. Approximately 18 percent of elderly rate their health as bad. In popular, older women have greater difficulty in acting ADLs than guys?

Performing instrumental ADLs (IADLs) which includes the ability to telephone, shopping, meals education, housekeeping, doing laundry, travelling,

responsibility for own remedy and capability to handle price range calls for more skill, judgement and independence than acting ADLs. The survey covering the eight domain names of IADL determined that about 66 percent of the aged have issue in preparing food and 60 percentage in going shopping. A region of the elderly reported issues with the usage of the telephone and 40 percent with doing the laundry.

Based on the findings of the take a look at, destiny demand for ADL services should be estimated in two scenarios:

(I) in destiny years, the percentage of aged with ADL difficulties remains equal as in 2011; and (II) in future years, the percentage of elderly with ADL difficulties increases with populace ageing (as observed in some evolved countries).

In Scenario II, the growth in the proportion of aged and life expectancy growth at age 60 (as determined in developed international locations) make contributions to ADL service demand. As consistent with writer analysis, those two factors explained around 81 percentage of trade in ADL over a period of time in the pick out evolved international locations.

Scenario II projections primarily based at the 2011 survey records show that via 2020 (just 4 years from now), there will be around 12 million elderly requiring ADL assistance, a range on the way to enlarge to 17.8 million by 2030 and 37.9 million by 2050 (Table 7.1).

In addition to ADL problems, the elderly also be afflicted by chronic illnesses that want non-stop care in the longer term. The BKPAI 2012 survey pegged the percent of elderly in India with one or more chronic situations at 65 percent. If it's far assumed that in destiny years, the share of elderly with specific continual diseases will remain on the identical fees as 2011, the quantity of aged with at the least one chronic disease will move up from 67.3 million in 2011 to 213.9 million in 2050 (Table 7.2).

Clearly, to meet the future demand for ADL offerings and continual disease management, a multipronged strategy is wanted and distinctive fashions of care need to be attempted out.

IPOP additionally supports eight Regional Resource and Training Centers (RRTCs) as lead NGOs placed in different regions of the country so that you can broaden capability of

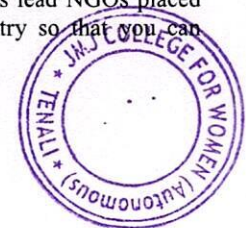


Table1. Number of Elderly Persons with Difficulties in performing at least One ADL (India, 2015–2050)

Year	Scenario I (assuming % of elderly with ADL issues remains constant 2011 onward)	Scenario II (% of elderly with ADL issues increases with population ageing as observed in select developed countries)	
	No. of elderly (million)	Projected percentage	No. of elderly (million)
2011	7.9	7.6	7.9
2015	8.9	8.3	9.7
2020	10.6	8.6	12.0
2030	14.5	9.4	17.8
2050	25.1	11.5	37.9

**Elderly Care Services that Need Special Attention**

The survey showed that about half the elderly feel that the government should provide support during old age. In particular there is a need to have community-based day-care centers for the elderly providing services such as skill building, financial and legal advice, entertainment, exercise and other ways of active ageing, with effective linkages with the public health system. Specific attention is needed to build capacity in home-based and community-based care for the elderly. At the family level, stronger intergenerational bonding is a priority while at the community level, greater participation and involvement of the elderly is important.

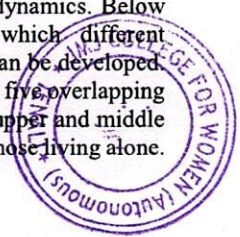
**The other priority areas include:**

- Elderly living in poor urban dwellings who need more age-friendly facilities;
- Access to social security schemes, including old-age pensions without errors of inclusion or exclusion;
- Community mobilization and engagement in social and cultural activities;
- Appropriate avenues of gainful employment for the elderly who are still willing and able to work; greater involvement of corporate entities in enhancing the quality of life of the elderly by linking with corporate social responsibility (CSR) activities;
- food security for the elderly; • routine screening for age-related diseases followed by proper medical attention; and

- addressing depression caused by high level of chronic morbidities through activities to keep the elderly socially engaged and mentally fit.

**A. Segmentation Approach**

Senior citizens in India belong to diverse groups although majority of them live in rural areas, are illiterate, dependent, poor and carry significant morbidity burden. Consequently, the ageing issues are also different and a lot depends on the family support system the elderly enjoy. The heterogeneity among the elderly population must be factored into framing appropriate models of care for them. As the steady shift away from care-giving in a traditional joint family continues, there is likely to be a decrease in elder care by adult children in the future, which will create more demand for old-age homes. Public policy in India has to decide on an appropriate combination of family care and institutional/community care for our elderly. Some scholars believe that due to high cost we cannot fully depend on institutional care as a priority but should develop models of home or family care supplemented by a variety of respite services suitable for our cultural context<sup>78</sup>. Such models would be influenced by factors such as rural–urban residence, social class differences and gender dynamics. Below are a few considerations upon which different combinations of care of the elderly can be developed. Needs for care of elderly differ across five overlapping segments—rural, urban poor, urban upper and middle income elderly, elderly women, and those living alone.



### B. Rural elderly

The traditional support systems of family, kinship and community were once considered strong enough to provide social security to older people, particularly in rural areas. But today these traditional values and norms have become weak as joint family arrangements and value systems are being eroded partly due to migration for work and increasing participation of women in workforce. The elderly who are left behind often depend on money sent by children who do not live with them, flows which may be intermittent and in some cases entirely absent.

To supplement, the rural parents are often forced to find work in the informal sector with its attendant insecurities. In addition they also lack access to good health care services and do not get adequate support from old-age pension schemes. For this group of rural elderly, support for increased access and use of dedicated income and health security provisions is a priority. They also need to be better aware of active ageing principles and taking care of one's own health to the extent possible. This is a priority for the government and NGO partners as well as for Panchayati Raj institutions (PRIs) to meet the needs of rural elderly.

For this segment, a package of care addressing health security, food security and financial security appears to be the felt need. Strengthening the primary health care system in ways anticipated under the NPHCE is a priority for health security.

To increase accessibility, mobile medical clinics of Help Age India provide a good model to scale up. Food insecurity of the rural poor elderly is a result of lack of income or asset ownership and hence dependence on doles and transfers. To address the issue without creating additional services and structures, it is suggested that anganwadis expand the direct feeding programs of ICDS to cover the elderly.

Financial security can be addressed through ESHGs initiated by Help Age India, Leveraging provisions under MNREGA to increase the scope of work for the able elderly, and increasing the amount and coverage of national old-age pension schemes.

### C. Urban poor elderly

When the elderly decide to move to urban areas, they face the consequences of transition from rural living to urban slums and settlements which are congested and unsanitary as also beset with crime and alcoholism. To this group of elderly, more secure living arrangements

and health care would be the priority. The National Urban Health Program as well as the NPHCE should focus on such marginalized urban elderly population more strongly. Strengthening of municipal health systems particularly in geriatric care with a focus on chronic conditions and non-communicable diseases (NCDs) is essential. There is a need to design models of social and community-based care for the urban poor elderly. Networking between organizations working for senior citizens, old-age homes as well as day care centers is necessary for greater community participation and socialization of the elderly who may otherwise experience loneliness.

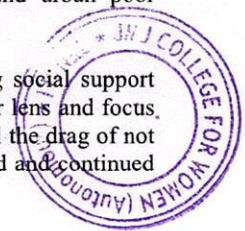
### D. Urban upper and middle income elderly

In this group the elderly are generally healthy and active and are often able to lead productive and purposeful post retirement lives. While rural India continues to be family-dependent in old age, the urban upper and middle income elderly benefit from the migration of their children to better employment opportunities. Many are well-off precisely because of their prosperous children but are left alone to take care of themselves; more often than not, they are quite capable of doing so. Strengthening systems of formal and reliable care-giving is essential for this segment of elderly. Promoting age-friendly community-based initiatives for socialization as well as for active ageing can fulfil the felt needs of this segment.

### E. Elderly women

As discussed in Chapter 2, there are significant gender differentials in longevity, loss of spouse, income and asset ownership, living arrangements and health. Care-giving responsibilities are largely expected to be borne by women both young and old. Traditional gender roles often restrict women within their home without much decision-making power. The engendering of roles experienced by women throughout their life course becomes particularly explicit in later years and often exposes elderly women to greater risk of ill-health. It therefore appears that ageing poses more challenges for women than for men. As most women outlive their husbands, they are more likely to be saddled with care-giving tasks in the family, leading to deteriorating health and mental stress. This restricts their ability to be employed even if they are qualified and makes them economically dependent on others. IN case they are employed, they are often expected to carry responsibility of both home and work front, especially if they belong to rural and urban poor families.

It is necessary to review the existing social support programs for elderly through a gender lens and focus, on problems of older women who pull the drag of not just by their age, but also widow hood and continued



gender bias throughout their life course. Counselling services for elderly women as well as their family members to combat social isolation, lack of awareness and knowledge and elder abuse is essential. Special health care services for older women with a focus on NCDs will address the multiple morbidities.

#### F. Elderly living alone

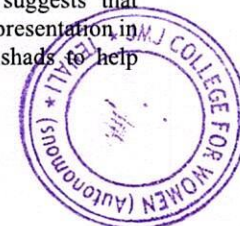
Of central importance to the elderly living alone (particularly women), is community-based care involving other senior citizens, children and youth. Some attempts like, "Adopt a Granny" by schoolchildren to strengthen intergenerational bonds are known to show positive outcomes. Protection by law and police for elderly living alone is essential.

#### Conclusion:

This review presented that the level of evidence available to support an association between elevated issues of the senior citizen levels and cognitive function was generally weak and inconsistent. Future studies with better methodological quality are needed.

#### REFERENCE

- Using data from the 24<sup>th</sup> round of UN population estimates, the report says the elderly population in Asia is estimated to increase from 10.5 per cent in 2012 to 22.4 per cent in 2050. In India, it is expected to rise from 8 per cent in 2015 to 19 per cent in 2050, and to 34 per cent by the end of the century.
- Three key demographic changes – declining fertility, reduction in mortality and increasing survival at older ages – contribute to population ageing.
- The elderly population in India varies across states and regions, the report says, drawing on data from Census 2011. Kerala, Tamil Nadu, Himachal Pradesh, Punjab, Karnataka and Andhra Pradesh have the highest percentage of senior citizens, and in that sequence. States with a lower elderly population include Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Jharkhand and Assam.
- The report says that family remains the first social institution for elder care in India. With migration for employment on the rise, the ability or willingness of children to look after older parents, or live with them, is declining.
- The population of those above the age of 80 years is estimated to grow by 700 per cent, between 2000 and 2050, the report notes, drawing on data from *The State of Elderly in India, 2014*. There is a predominance of widowed and 'highly dependent' women in this age group. The concerns of this category should be specifically addressed by government policy and programmes.
- Citing Census 2011, the report notes that 71 per cent of the elderly in India live in rural areas, where connectivity is poor, as is access to quality healthcare. Yet, the elderly prefer to live in their own communities rather than migrate to places that have such facilities.
- Drawing on the UNFPA's *Building a Knowledge Base on Population Ageing in India* (BKPAI) – a 2012 survey of the elderly population in seven Indian states (Himachal Pradesh, Punjab, West Bengal, Odisha, Maharashtra, Kerala and Tamil Nadu), the report says that about 26 per cent of men, and 60 per cent of women, do not have any personal income. Wages are a major source of income for older men, indicating that they work to support themselves.
- The report lists two main government of India initiatives for elder care – the National Programme for Health Care of the Elderly (NPHCE, started in 2010) and the Integrated Plan for Older Persons (IPOP, started in 1992). These, it claims, are comprehensive, cover a large area, and are adequately funded and executed.
- IPOP does not directly provide services – including food, shelter, and medical care – to the elderly, but does so through NGOs, Panchayati Raj Institutions and other local bodies.
- Several social security schemes also cover India's elderly, such as the Indira Gandhi National Old Age Pension Scheme, Indira Gandhi National Widow Pension Scheme, and Annapurna Yojana. The BKPAI survey showed that about 70 per cent of BPL (below poverty line) households were aware of such schemes. In the elderly population, this awareness was higher among males than females.
- Citing a 2015 study of social assistance by Pension Parishad (a network of groups) and the Tata Institute of Social Sciences, the report makes several recommendations. These include universalising social pensions, regular payments on a fixed date every month and a focus on vulnerable groups.
- Among other measures, the report recommends a standardisation of facilities in old-age homes across the country, implementation of subsidised health insurance for BPL households, and establishing senior citizen clubs to address loneliness and isolation. It also suggests that senior citizens should find better representation in the Rajya Sabha and Vidhan Parishads to help highlight their concerns.





# Connected domination number of cartesian product graphs of Cayley graphs with arithmetic graphs

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### Abstract

The notation  $G_1 \square G_2$  is the Cartesian product of two graphs. The vertex set of  $G_1 \square G_2$  is  $V_1 \times V_2$ , where  $V_1 \times V_2$  is the Cartesian product of the sets  $V_1$  and  $V_2$  and any two distinct vertices  $(u_1, v_1)$  and  $(u_2, v_2)$  of  $G_1 \square G_2$  are adjacent, if  $u_1 = u_2$  and  $v_1 v_2 \in (G_2)$  or  $u_1 u_2 \in E(G_1)$  and  $v_1 = v_2$ . In this paper we obtain some results related to connected domination number of Cartesian product graphs of Euler Totient Cayley graphs with Arithmetic  $V_n$  graphs.

### Keywords

Euler totient Cayley graph, Arithmetic  $V_n$  graph, Cartesian product graph, Connected domination.

### AMS Subject Classification 2010

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## Contents

1	Introduction .....	48
2	Euler Totient Cayley Graph .....	48
3	Arithmetic $V_n$ graph .....	49
4	Cartesian Product Graph of $G(Z_n, \phi)$ with $G(V_n)$ ...	49
5	Connected Dominating Sets of Cartesian Product Graph	49
6	Conclusion .....	51
7	Acknowledgment .....	51
	References .....	51

## 1. Introduction

Domination in Graphs is a prospering region of research at present. Domination sets assume a significant job in down to earth applications. for example, co-ordinations and systems structure, portable processing, asset designation and media transmission and so forth. Cayleygraphs are great models for interconnection systems, explored regarding equal handling and circulated calculation.

Nathanson [1] was the pioneer in presenting the ideas of Number Theory, especially, the 'Hypothesis of Congruences' in Graph Theory, hence made ready for the development of another class of graphs, in particular "Arithmetic Graphs".

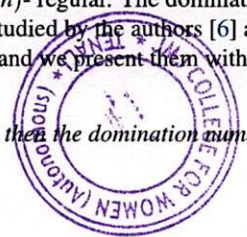
Cayley Graphs are another class of graphs related with components of a group. In this group is related with some Arithmetic functions, at that point the Cayley graph turns into an Arithmetic graph. The Cayley graph related with Euler totient function is known as an Euler totient Cayley graph.

The Cartesian product of graphs is a straight forward and common development. As per Imrich and Klavzar [2], Cartesian results of graph were characterized in 1912 by Whitehead and Russell [3]. These products were repeatedly rediscovering later, outstandingly by [4] in 1960.

## 2. Euler Totient Cayley Graph

The Euler totient Cayley graph  $G(Z_n, \phi)$  is a graph whose vertex set  $V$  is given by  $Z_n = \{0, 1, 2, 3, \dots, n - 1\}$  and the edge set is  $E = \{(x, y) \mid x - y \in \text{ory} - x \in S\}$ , where  $S$  denotes the set of all positive integers less than  $n$  and relatively prime to  $n$ . That is  $S = \{r \mid 1 \leq r \leq n \text{ and } \text{GCD}(r, n) = 1\}$ . Then  $|S| = \phi(n)$ . Some properties of Euler totient Cayley graphs and enumeration of Hamilton cycles and triangles can be found in Madhavi [5]. The Euler totient Cayley graph is a complete graph if  $n$  is a prime and it is  $\phi(n)$ - regular. The domination parameters of these graphs are studied by the authors [6] and we require the following results and we present them without proofs.

**Lemma 2.1.** [6] If  $n$  is a prime, then the domination number



of  $G(Z_n, \phi)$  is 1.

**Lemma 2.2.** [6] If  $n$  is power of a prime, then the domination number of  $G(Z_n, \phi)$  is 2.

**Lemma 2.3.** [6] The domination number of  $G(Z_n, \phi)$  is 2, if  $n = 2p$  where  $p$  is an odd prime.

**Lemma 2.4.** [6] Suppose  $n$  is neither a prime nor  $2p$ . Let  $n = p_1^{(\alpha_1)} p_2^{(\alpha_2)} \dots p_k^{(\alpha_k)}$ , where  $p_1, p_2, \dots, p_k$  are primes and  $\alpha_1, \alpha_2, \dots, \alpha_k$  are integers  $\geq 1$ . Then the domination number of  $G(Z_n, \phi)$  is given by  $\gamma(G(Z_n, \phi)) = \lambda + 1$ , where  $\lambda$  is the length of the longest stretch of consecutive integers in  $V$ , each of which shares a prime factor with  $n$ .

### 3. Arithmetic $V_n$ graph

Let  $n > 1$ , such that  $n = p_1^{(\alpha_1)} p_2^{(\alpha_2)} \dots p_k^{(\alpha_k)}$ . Then the Arithmetic  $V_n$  graph is characterized as the graph whose vertex set comprises of the divisors of  $n$  and two vertices  $u, v$  are adjacent in  $V_n$  graph if and only if  $GCD(u, v) = p_i$ , for some prime divisor  $p_i$  of  $n$ .

In this graph vertex '1' becomes an isolated vertex. Hence we ignore Arithmetic  $V_n$  graph with isolated vertex, as the contribution of vertex '1' is nothing, in the study of some domination parameters and properties of these graphs.

For every prime  $n$ ,  $V_n$  contains an isolated vertex so  $V_n$  is connected. Otherwise, by the adjacency of  $V_n$  graph, there are edges between prime number vertices and their prime power vertices and also to their prime product vertices. So,  $V_n$  is connected for every  $n$ .

The domination parameters of these graphs are obtained by the author and the proof of the following theorem can be found in [7].

**Theorem 3.1.** [7] If  $n = p_1^{(\alpha_1)} p_2^{(\alpha_2)} \dots p_k^{(\alpha_k)}$ , where  $p_1, p_2, \dots, p_k$  are primes and  $\alpha_1, \alpha_2, \dots, \alpha_k$  are integers  $\geq 1$ , then the domination number of  $G(V_n)$  is given by

$$\gamma(G(V_n)) = \begin{cases} k - i, & \text{if } \alpha_i = 1 \text{ for more than one } i \\ k, & \text{Otherwise.} \end{cases}$$

where  $k$  is the core of  $n$ .

### 4. Cartesian Product Graph of $G(Z_n, \phi)$ with $G(V_n)$

In this paper we consider the Cartesian product graph of Euler Totient Cayley graph with Arithmetic  $V_n$  graph. The properties and some domination parameters of these graphs are studied by the author in [8].

Let  $G_1$  denote the Euler Totient Cayley graph  $G(Z_n, \phi)$  and  $G_2$  denote the Arithmetic graph  $G(V_n)$ . Then  $G_1$  and  $G_2$  are simple graphs as they have no loops and multiple edges. Hence by the definition of adjacency in Cartesian product,  $G_1 \square G_2$  is also a simple graph. The Cartesian product graph

$G_1 \square G_2$  is a complete graph, if  $n$  is a prime and the degree of a vertex in  $G_1 \square G_2$  is given by  $deg_{(G_1 \square G_2)}(u_i, v_j) = deg_{G_1}(u_i) + deg_{G_2}(v_j)$ .

### 5. Connected Dominating Sets of Cartesian Product Graph

In this section we find minimum connected dominating sets of Cartesian product graph of  $G(Z_n, \phi)$  graph with  $G(V_n)$  graph and obtain its connected domination number in various cases.

Let  $G(V, E)$  be a graph and  $u, v \in V$ . A subset  $D$  of  $V(G)$  is a dominating set of  $G$  if every vertex in  $V - D$  is adjacent to a vertex in  $D$ . The dominating set  $D$  of  $G$  is said to be a connected dominating set if the induced subgraph  $\langle D \rangle$  is connected. The minimum cardinality of a connected dominating set of  $G$  is called the connected domination number of  $G$  and is denoted by  $\gamma_c(G)$ .

**Theorem 5.1.** If  $n$  is a prime, then the connected domination number of  $G_1 \square G_2$  is 1.

*Proof.*  $n = 11$

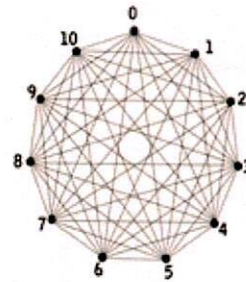


Figure1:  $G_1 = G(Z_{11}, \phi)$

●  
11

Figure2:  $G_2 = G(V_{11})$

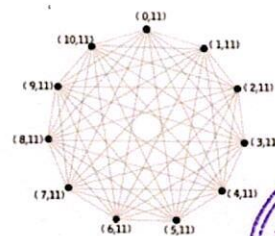


Figure3:  $G_1 \square G_2$   
Connected dominating set:  $\{(0,1)\}$

Suppose  $n$  is a prime, then the graph  $G_1 \square G_2$  is a complete graph and every single vertex of  $G_1 \square G_2$  constitutes a



dominating set. Obviously this dominating set becomes a connected dominating set.  
Hence  $\gamma_c(G_1 \square G_2) = 1$ . □

**Theorem 5.2.** Suppose  $n = 2p$  where  $p$  is an odd prime, then the connected domination number of  $G_1 \square G_2$  is 8.

*Proof.*  $n=2 \cdot 3=6$

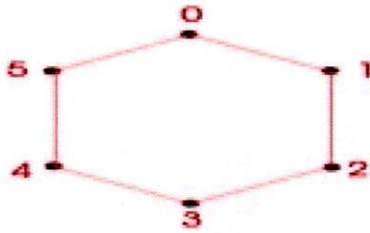


Figure4:  $G_1 = G(Z_6, \phi)$

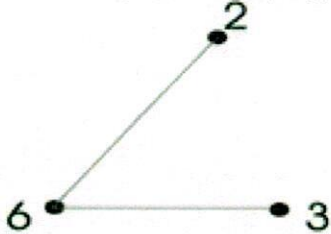


Figure5:  $G_2 = G(V_6)$

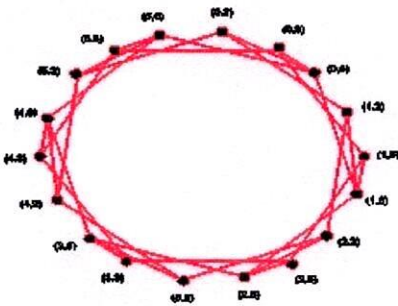


Figure6:  $G_1 \square G_2$

Connected dominating set:

$$\{(0, 2), (0, 3), (0, 6), (1, 6), (2, 6), (3, 2), (3, 3), (3, 6)\}$$

Suppose  $n = 2p$ , where  $p$  is an odd prime. Consider the graph  $G_1 \square G_2$ . To find a connected dominating set of  $G_1 \square G_2$ , we start our investigation with the dominating set  $D$  of  $G_1 \square G_2$  with minimum cardinality, which is defined in Theorem 2.3 as  $D = \{(U_{(d_1)}, 2), (u_{(d_1)}, p), (u_{(d_1)}, 2p), (u_{(d_2)}, 2), (u_{(d_2)}, p), (u_{(d_2)}, 2p)\}$ . Where  $|u_{(d_1)} - u_{(d_2)}| = p$ .

Since  $GCD(2, 2p) = 2$  and  $GCD(p, 2p) = p$ , it follows that the vertices  $(U_{(d_1)}, 2), (U_{(d_1)}, 2p)$  are connected to the vertex  $(U_{(d_1)}, p)$ . By the same argument, vertices  $(u_{(d_2)}, 2), (u_{(d_2)}, p)$  are connected to the vertex  $(u_{(d_2)}, 2p)$ .

Further  $|u_{(d_1)} - u_{(d_2)}| = p$  implies that  $u_{(d_1)} \neq u_{(d_2)}$  and  $GCD(u_{(d_1)} - u_{(d_2)}, n) \neq 1$ . Hence vertex  $u_{(d_1)}$  is not adjacent to vertex  $u_{(d_2)}$ . From this it is clear that no vertex of  $\{(U_{(d_1)}, 2), (u_{(d_1)}, p), (u_{(d_1)}, 2p)\}$  is connected to any vertex of  $\{(u_{(d_2)}, 2), (u_{(d_2)}, p), (u_{(d_2)}, 2p)\}$ . Thus  $D$  is not a connected dominating set.

In order to connect these two subsets of  $D$ , we have to include a vertex  $(u_{(d_1)} + 1, 2p)$  into  $D$ . Now the included vertex  $(u_{(d_1)} + 1, 2p)$  is connected to the vertex  $(u_{(d_1)}, 2p)$  as  $u_{(d_1)} + 1 - u_{(d_1)} = 1$  and  $GCD(1, n) = 1$ .

Further the included vertex  $(u_{(d_1)} + 1, 2p)$  in  $D$  is not connected to any one of  $(u_{(d_2)}, 2), (u_{(d_2)}, p), (u_{(d_2)}, 2p)$  because  $|u_{(d_1)} - u_{(d_2)}| = p$ ,  $p$  is an odd prime, and hence  $|u_{(d_1)} + 1 - u_{(d_2)}| = p + 1$  which is an even number and hence  $GCD(u_{(d_1)} + 1 - u_{(d_2)}, n) = GCD(u_{(d_1)} + 1 - u_{(d_2)}, 2p) \neq 1$ .

Hence we need to include another vertex  $(u_{(d_2)} - 1, 2p)$  into  $D_c$ , which is connected to the vertex  $(u_{(d_2)}, 2p)$  as  $u_{(d_2)} - (u_{(d_2)} - 1) = 1$  and  $GCD(1, n) = 1$ . (Such a vertex  $(u_{(d_2)} - 1, 2p)$  must exist because  $|u_{(d_1)} - u_{(d_2)}| = p$ ). Now the newly included vertex  $(u_{(d_2)} - 1, 2p)$  in  $D$  is connected to the vertex  $(u_{(d_1)} + 1, 2p)$  as  $(u_{(d_2)} - 1) - (u_{(d_1)} + 1) = p - 2$  and  $GCD(p - 2, n) = 1$ . (Since  $p$  is odd we have  $p - 2$  is odd). Thus the set  $D = \{(U_{(d_1)}, 2), (u_{(d_1)}, p), (u_{(d_1)}, 2p), (u_{(d_1)} + 1, 2p), (u_{(d_2)}, 2), (u_{(d_2)}, p), (u_{(d_2)}, 2p), (u_{(d_2)} - 1, 2p)\}$  becomes a dominating set of  $(G_1 \square G_2)$  with minimum cardinality and which is connected.

Hence  $\gamma_c(G_1 \square G_2) = |D'| = 8$ . □

**Theorem 5.3.** If  $n$  is not a prime, then  $\gamma_c(G_1 \square G_2) = \lambda + 1 \cdot |V_2|$  where  $\lambda$  is the length of the longest stretch of consecutive integers in  $V_1$  of  $G_1$  each of which shares a prime factor with  $n$ .

*Proof.*  $n = 2^2 = 4$

In Lemma 2.4, we proved that  $D_{(c_1)} = \{u_{(d_1)}, u_{(d_2)}, \dots, u_{(d_{\lambda+1})}\}$  is a dominating set of  $G_1$  with minimum cardinality  $\lambda + 1$ .

Let  $V_2 = \{v_1, v_2, \dots, v_m\}$  be the vertex set of  $G_2$ .

Consider  $D_c = D_{(c_1)} \times V_2$

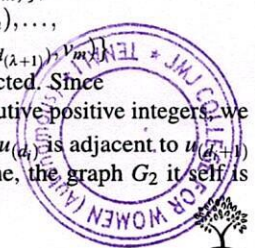
$$= \{u_{(d_1)}, u_{(d_2)}, \dots, u_{(d_{\lambda+1})}\} \times \{v_1, v_2, \dots, v_m\}$$

$$= \{(u_{(d_1)}, v_1), (u_{(d_1)}, v_2), \dots, (u_{(d_1)}, v_m)\},$$

$$\{(u_{(d_2)}, v_1), (u_{(d_2)}, v_2), \dots, (u_{(d_2)}, v_m), \dots,$$

$$(u_{(d_{\lambda+1})}, v_1), (u_{(d_{\lambda+1})}, v_2), \dots, (u_{(d_{\lambda+1})}, v_m)\}$$

We now prove that  $D_c$  is connected. Since  $u_{(d_1)}, u_{(d_2)}, \dots, u_{(d_{\lambda+1})}$  are consecutive positive integers, we have  $|u_{(d_i)} - u_{(d_{i+1})}| = 1$ . Hence each  $u_{(d_i)}$  is adjacent to  $u_{(d_{i+1})}$  for  $1 \leq i \leq \lambda$ . Since  $n$  is not a prime, the graph  $G_2$  itself is





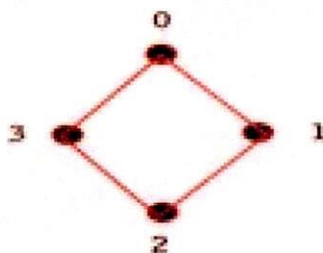


Figure7:  $G_1 = G(Z_4, \phi)$

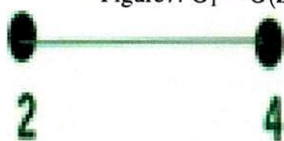


Figure8:  $G_2 = G(V_4)$

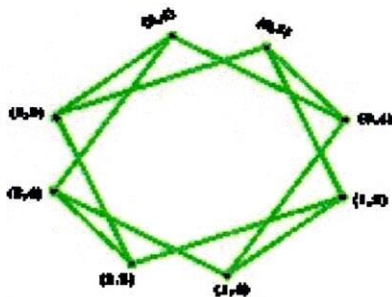


Figure9:  $G_1 \square G_2$

Connected dominating set:  $\{(0, 2), (0, 4), (1, 2), (1, 4)\}$

a connected graph. It means, if  $v_j$  is any vertex in  $v_1, v_2, \dots, v_m$  then  $v_j$  is connected to each of the other vertices of  $v_1, v_2, \dots, v_m$ . Hence by the definition of the Cartesian product we can see that, each  $u_{(d_i)}, v_j$  is connected to the vertices  $(u_{(d_i+1)}, v_j)$  and  $(u_{(d_i)}, v_l)$  where  $1 \leq i \leq \lambda$  and  $v_j, v_l \in \{v_1, v_2, \dots, v_m\}$ . Thus the dominating set  $D_c$  of  $G_1 \square G_2$ , becomes a connected dominating set of  $G_1 \square G_2$ . Hence  $\gamma_c G_1 \square G_2 \geq |D_c| = (\lambda + 1) \cdot |V_2|$ .

Suppose we delete a vertex, say  $(u_{(d_i)}, v)$  from  $D$  for some  $i, 1 \leq i \leq \lambda + 1$ . Since each vertex in  $G_1$  is of degree  $\phi(n)$ , vertex  $u_{(d_i)}$  is adjacent to the vertices, say  $u_1, u_2, \dots, u_{\phi(n)}$  respectively. Then the vertices  $(u_1, v), (u_2, v), \dots, (u_{\phi(n)}, v)$  are all not dominated by other vertices of  $D - \{(u_{(d_i)}, v)\}$ . If so then  $u_1, u_2, \dots, u_{\phi(n)}$  are also dominated by other vertices of  $u_1, u_2, \dots, u_{\phi(n)}$  which implies that  $D_1$  is not a minimum dominating set of  $G_1$ , a contradiction. Therefore  $D$  is a minimal connected dominating set of  $G_1 \square G_2$ . Hence  $\lambda_c(G_1 \square G_2) = (\lambda + 1) |V_2|$ .

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### 6. Conclusion

The objective of this work is to familiarize the reader with the Cartesian product graph of Euler Totient Cayley graph with Arithmetic  $V_n$  graph. The purpose of studying basic properties and various domination parameters of Cartesian product graphs that arise from the Arithmetic graphs and Cayley graphs is to enhance the behavioural aspects of these graphs and gives new dimensions to the theory of Cartesian product graphs. It is useful other Researchers for further studies of other properties of these product graphs and their relevance in both combinatorial problems and classical algebraic problems.

### 7. Acknowledgment

We are very much thankful to the reviewers for their suggestions and we incorporated the necessary changes.

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## Secondary School English Teachers Development by Information Technology

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**Abstract:** Taking professional development of secondary school English instructors (SSETs) as cognizance, a case examine is made in Shandong province. According to the evaluation of the studies, the non-constructive state and imbalance of professional development to SSETs in exclusive districts are found out, and the common problems ---- time-hassle, nonsystematic persevering with professional improvement (CPD) and non- steerage in professional development ---- are discussed. To change the state of affairs and remedy the problems, a viable 3-level model of SSETs' expert improvement is hooked up on the basis of the application of realistic and powerful data generation paperwork as weblog, on-line chat, , hoping to offer a few enlightenment to the schooling of SSETs' expert development

**Keywords-** information technology; p

### I. INTRODUCTION

Expert improvement is one crucial part of one's lifelong gaining knowledge of in a observe area. it is also a hot subject matter on training. To most pupils, the focus of professional development is within the pre-profession education stage. The fact is that professional improvement in-profession is extra essential, due to the fact the continuing professional development is the inspiration on which one's work based totally, and is the dynamic energy pushing one to move further in his career. at the research finished in Shandong province, the present paper focuses on the way to practice the facts technology to the professional improvement of secondary college English instructor (SSET for quick), hoping to present a strategy to the issues current in that discipline at present.

### II. METHODOLOGY

#### A. Professional development

The term expert development in this paper intends to employ its easy feel. Expert improvement often refers to verbal and tactile abilities required for preserving a specific profession course or to general competencies provided thru continuing schooling, including the

extra standard capabilities region of personal development. it is able to be seen as training to keep modern-day with converting generation and practices in a profession or in the concept of lifelong studying. developing and enforcing a software of expert improvement is usually a feature of the human resources or agency improvement branch of a big corporation or group. In a large feel professional improvement may additionally include formal varieties of vocational education, generally put up-secondary or poly-technical education main to qualification or a credential required to get or maintain employment. Informal or individualized programs of expert development may additionally encompass the concept of personal training.

#### B. Research subject

On the way to discover the prevailing nation of expert development of SSET in Shandong province, the subjects of the research are decided on at random. 30 top secondary faculty English instructors who have acquired grasp diploma of training are decided on, their master degree theses are studied, and tracking survey on their continuing professional development are made; 50 secondary school English instructors in the district of Jinan, Qingdao, Jining, Heze are required to fulfill the questionnaires, 60 SSETs from the towns and rural places of the district of Linli, Yantai, Zaozhuang, Taian, Zibo are interviewed.

#### C. Data resources

- master degree thesis. 30 master diploma theses of education are amassed (of them, 25 are from Qufu regular university, 5 from Shandong regular college), the not unusual capabilities are studied.
- Questionnaires. The tracking survey on persevering with expert development to the authors of 30 master degree theses of training is particularly finished by using questionnaires. Questionnaires are given to 50 commonplace SSETs in different districts, with the motive to find out the kingdom of professional improvement to not unusual SSETs.



- Interview. Making right use of the chance of website hosting the take a look at of basic competencies for number one and secondary English teachers, 60 SSETs from the towns and rural places of the specific districts in Shandong province are interviewed, in order to reveal the state of the SSETs' professional improvement in rural

### III. DATA ANALYSIS

According to the analysis on the data collected, the present state and the common problems on professional development of SSETs are revealed.

#### A. The Present State of Professional Development of SSETs in Shandong Province

Non-constructive state of in-paintings professional improvement. in comparison with the systematic pre-profession schooling, most SSETs' in-paintings expert development is some distance from delight. 30 accumulated grasp degree theses all exhibit a hit experimental have a look at on educational concept's (theories) application to particular English studying covering listening, speak me, studying or writing. in line with the monitoring survey of these 30 theses' writers, seventy 3.3% of them (22 teachers) consciously hired the academic theories they found out systematically in the university for the primary yr after their graduation. years later the range decreased to 33.3% (10 teachers). Only thirteen.3% of them (four teachers) persisted the experimental research. in line with the answers given to the questionnaires and the interview, 42.7% of one hundred ten (forty seven instructors) SSETs have no concept approximately what trouble(s) present in teaching, and among these 47 instructors, 10 don't realize what are had to develop their professional competence.

- Imbalance of expert development to SSETs in cities and in rural places. An apparent truth found out via the studies is that expert development is imbalanced. despite the fact that average age is very approximate, the degree, frequency and manner of professional development are much one of a kind to SSETs in one of a kind districts; inside the identical district, there is nonetheless a massive space among SSETs in towns and in rural places. SSETs in Jinan, Qingdao, and Yantai are exposed to more chances and diverse methods to expand their expert competence than those inside the districts of Heze and Zaozhuang. To SSETs in towns, available internet facts, model lesson plan, often hold go-school model classes to alternate teaching experience can similarly their professional development; to SSETs in rural locations,

the predominant way to develop their expert competence self study from books, the possibilities of brief-time formal training in educational training can fell on.

#### B. The common problems on professional development of SSETs

To the problems they face to develop their professional competence, the primary three indexed are time trouble, nonsystematic continuing professional improvement, and non-steering in expert development.

- Time predicament. 87.6% of the one hundred forty researched SSETs (123teachers) recall time because the first problem to address. Making ready lesson and checking homework of college students take a huge a part of their spare time. Heavy-loaded coaching work lets in them little time to consider their expert development. They just recognition on what's related to what are coaching approximately in magnificence. Historically, the systematic formal training is keep in their restricted excursion time.

- Non- systematic persevering with expert development (shorted as CPD). CPD is the conscious updating of expert knowledge and the development of expert competence at some stage in someone's running existence. it's miles a commitment to being professional, retaining updated and continuously in search of to improve. As time is restricted, sixty eight.6% of the a hundred and forty researched SSETs (96teachers) admit their aware updating of expert expertise is not systematic. They simply try to solve the issues appeared of their teaching, fifty seven.3% of that 96 SSETs notion the answers they found aren't first-rate.

- Non-steerage in expert improvement. 72 of 110 SSETs (65.5%) who answer the questionnaires and interviews regard steerage as crucial element of their expert development. They don't have any clean plan to develop their professional competence. at some stage in the interview, 9 SSETs even don't realize what should encompass in their professional competence.

#### IV. THE APPLICATION OF INFORMATION TECHNOLOGY TO PROFESSIONAL DEVELOPMENT OF SSETs

Whether or not generation ought to be utilized in colleges is no longer the difficulty in education. Alternatively, the contemporary emphasis is making sure that technology is used successfully to create new opportunities for gaining knowledge of and to sell achievement. Facts and communication era has developed to offer coaching and getting to know as a more superior medium. for this reason, the way to



follow data era to remedy the present issues and enhance the effectiveness and efficiency of SSETs' expert improvement is simply the point.

#### A. The application of information technology to SSETs'

Expert improvement and adult getting to know concept effective expert development utilizes key factors from adult learning idea. Adults require relevant, concrete reports with good enough help, appropriate remarks, and lengthy-term observe-up (Speck, 1996). This kind of expert improvement could be very one of a kind from traditional one-time trainer workshops. Expert improvement in a technological age requires new paperwork and new sources. It cannot take the traditional varieties of character workshops or one-time training periods. Rather, it have to be viewed as an ongoing and quintessential part of instructors' professional lives. Research (David, 1996; Guhlin, 1996) indicates that teachers study and incorporate new data exceptional when it's miles supplied over a long term frame in preference to a single consultation. The software of information era to SSETs' expert improvement is the final results of the time. at the records technology, technology encourages teachers to tackle new and improved roles. the present scholar-focused teaching coaching requires instructors to count on the position of educate or facilitator even as college students paintings collaboratively. The professional development inside the new time requires instructors peer advisors operating collectively on huge packages, in place of working in isolation.

The application of records era to SSETs' professional development meets such requirements. International internet supports SSETs to search records, to board remarks, to gather information, and to check hypotheses of teaching and gaining knowledge of, permits distance collaboration with move-college peer organizations and look at companies through telecommunications. The getting to know journal based totally weblog permits for extra interaction between educators, helps instructor collaboration, affords systematic steerage and enough time and comply with-up support for teachers to master new content and strategies, to integrate them into their practice, and to reflect on ideas. Online chats and e-mails make SSETs have access to follow-up discussion and collegial activities, for sharing ideas and thoughts electronically rather than face-to-face.

#### B. Information technology forms applying to professional

Development The information technology which can follow to the SSETs' expert improvement includes

such popular paperwork as blog, on-line chat and lec which are available to maximum SSETs at gift. Blogs (weblogs) are one of the fastest grow in capabilities of the net A weblog is essentially a personal internet based area for writing managed by way of the author who compiles lists of hyperlinks to in my view fascinated substances interspersed with records and editorial. it's far a personal online magazine this is regularly up to date and intended for general public intake. The university professors create their very own blogs to demonstrate the plan of expert development and listing topics to be discussed; SSETs can write their getting to know journal and personal reviews of teaching and gaining knowledge of. In well known the getting to know magazine is a way of documenting gaining knowledge of and accumulating records for self-analysis and mirrored image.

It is used as a shape of remarks for the teacher or used as a way of selling reflective inquiry. on-line chat is a two-way synchronous shape of laptop mediated conversation (CMC). Using online chat applications collaboration organization individuals can communicate on their teaching and gaining knowledge of issues and speak on viable solutions or on one topic assigned to them. not unusual experiences and interests provide a likely networked network, as well as the opportunity for ongoing interactions and sharing between individuals lengthy after the course or schooling has been finished. is the fast shape for electronic mail, the transmission of messages over communications networks. Generally, it takes only some seconds or mins for e mail to arrive at its vacation spot. That is a especially powerful manner to speak with a set due to the fact you may broadcast a message or document to anyone inside the group without delay. by email individual evaluation to think about viable guidelines for profession improvement, the lengthy-time period expert improvement plan, and reflection on learning and coaching can be exchanged among collaboration organization members.

#### C. The three-stage model of SSETs' professional development

Based totally at the person gaining knowledge of theory, realistic and effective varieties of records technology are implemented to SSETs' professional improvement, after which a viable 3-degree model is hooked up. The version may be defined as following:  
**The first stage:** The discovered English professors majoring training in ordinary universities cooperate collectively to make themselves be acquainted with the curriculum, the troubles and the existing kingdom of English teaching in secondary faculties, then workout the training plan for SSETs' professional development.



The second stage: Create the lengthy-term community and set up long-time period collaboration dating among and amongst professors and SSETs. With the learning magazine as the fundamental shape, observe such facts generation as blog, online chat, and electronic mail to the systematic education on coaching theories, experiments, and discussions approximately troubles in real teaching reviews. To those SSETs internet is inaccessible, the conventional way of correspondence and faraway distance studying takes the most important component.

The third stage: at the end of each semester, collaboration organization assembly is held to check the private and professional improvement to evaluate the plan, make a few adjustments to the plan to allow it be extra suitable to SSETs.

#### D. The effect of the three-stage model

After one-year's application of the three-stage version to 18 SSETs who obtained professional development training in Qufu regular college, questionnaires and interviews have been executed, approximately the attitude, the degree of delight, the diploma of popularization, the factors of befits, and the problems of the version. on the equal time, online survey changed into made in three professors' blogs and on the internet site of Linguistics route. 18 SSETs, who tested and skilled the new version of professional improvement schooling, compare it notably. They strongly propose the popularization of the version, because this new way of training can reinforce their theoretical and practical base of coaching work, melt the time contradiction among teaching and studying, broaden their imaginative and prescient of labor and lifestyles. To the sixty eight online solutions received, one hundred% of the SSETs welcome this new training manner, and 84% claim that data generation gain them loads, and it is a good deal beneficial to their expert development, especially in enhancing their coaching method and educational idea.

The most important troubles found out from the survey recognition on the conditions to expand this new way. Of route, the efficient and effective application of statistics era to SSETs' professional improvement is predicated on the authority's documentary and

economic support, the pass-college, cross-district cooperation, and the close collaboration between secondary colleges and normal universities. most effective these requirements are met appropriately can the improvement of the SSETs' professional development be realized.

This paper is a tentative observes of the software of records technology to SSETs' professional improvement. What is positive is that with the fast development of technology and society, the application fields of facts generation becomes wider and wider, and forms of records technology and the methods to use them to training might beyond our expectation.

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# ENGLISH LANGUAGE AND LITERATURE TEACHING METHODS IN COLLEGE RESEARCH

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## ABSTRACT:

In this paper, the language and literature English education, for example to explore the methods of the higher English education Language and literature expert publications for faculties and universities of English teaching according with tradition of the needs of English educators set the idea for improvement of arts coaching in primary and secondary colleges, is the important thing to discourage mining the exceptional of arts schooling.

**Keywords:** language and literature, teaching innovation.

## INTRODUCTION

Since for the reason that reform and establishing up India's English teaching has been sizeable development of the brand new basic coaching curriculum reform within the twenty-first century teachers in academic principles of teaching ideological teaching techniques path teaching mode a higher call for language and literature english teaching an critical part of coaching in India is foundation for development of primary and secondary faculty arts teaching is a key aspect in deterring the first-class of arts coaching so the new curriculum on the language and literature english trainer additionally raised a new and better requirements for a brand new issue for english schooling.

Students in grades not move as a substitute to test english within the check into colleges before deciding on a vocational english coaching professional, there may be no true have a look at conduct aren't interested in the expert courses, even those who graduate students can not find a task, no longer to

mention university graduates do not have lofty beliefs and aspirations, the goof in college felt that they may get a degree on the line, overdue for sophistication absences, do no longer listen cautiously, undisciplined, loose class to play smartphone, examination assessment, the effort inside the exam room.

English teaching majors, whether or not expert guides or cultural research, knowledge of standard understanding do no longer realize do no longer recognize, consisting of specialized guides now not know what a coloratura, and cultural knowledge do no longer know the time of the start of the Communist birthday party of India a variety of blind college students learning english, however in fact they're no longer low stage of cultural research, and only professional english fanatics, visit college, there's no stress and parental supervision of their studies, the less time spent in mastering, the school room teacher taught understanding of english tale of the scholars best while listening to the tale, the subsequent magnificence to ask questions, what do now not don't forget a number of instructors inside the college at the start only a few students go to the piano room piano, only before the very last exam, in order to sense to the momentum of the students a crash course.

Outstanding difficulty in the college English teaching may be summarized as dumb English, time-ingesting and inefficient". most of the people of English inexperienced persons research English considering junior high faculty (now there are many areas from the second and third grade) excessive school for six years learning English, maximum input college for in addition research, and two years of formal English education (English expert for four years), and a few admitted to graduate school but also research English, even inside the PhD nonetheless mastering English. Up to ten-12 years of English studying, most of the people of rookies still fluently communicate

English unfastened oral expression, the so-referred to as "dumb English". part of the learner check, gets excessive marks, but the actual software potential, interpersonal abilities are very bad. The crux of the dumb english, is too much emphasis on check-taking abilities and language talents of English, to the forget about of the cultivation of interpersonal talents. With the knowledge of domestic and foreign pupils on the character of language verbal exchange, inter non-public abilities training has become an quintessential part of foreign language coaching.

university English coaching is an critical a part of college schooling, it is a collection of a ramification of teaching models and teaching methods as one, language understanding and language competencies, learning techniques and intercultural conversation as the principle content material of the teaching system, university English coaching reform is a systematic mission. seeing that 2000, the college achieved a series of college English teaching exercise and studies paintings, in particular in college oral english teaching a series of reforms and try to reap encouraging consequences.

#### **ADDITION OF THE UNIVERSITY OF SPOKEN ENGLISH COURSE**

Over over time, my faculty only opened the "university English" guides will listen to English language teaching, speakme, studying, writing and translating integration. affected by the manner of the traditional check, the teachers within the coaching procedure best attention on schooling college students' listening, analyzing, writing, translation of the ability of 4 aspects of the overlook of the spoken language capacity, ensuing within the phenomenon of the dumb English. Order to get out of the plight of the dumb English, to develop students' oral communication ability to adapt to the new necessities of the social improvement of university students' English ability, since the 2004 rookies, the implementation of the university English curriculum reform further to the advent of the original college English courses, additionally opened a university English course. Oral path opened a total of four semesters, every semester for 32 hours in step with week, oral elegance. Open oral lessons to basically alternate the tendency of the traditional college English publications re-written, light communique. English coaching instructors is the lack of a commonplace trouble of the national better training, especially after the university enrollment in 1999, the dearth of instructors of English coaching is more obvious. Our school is not any exception, is likewise dealing with this situation. this case, how to promote the college English coaching reform? Use of existing instructors, English elegance reform, a large class of

intensive analyzing route in small lessons on oral elegance. extensive studying direction specializes in the expertise of the language enter, and consciousness on schooling college students' English ability, and took big training taught within the form of approximately 200. Lectures impact a good way to make certain the students' use of multimedia to massive lessons taught English instructions. this saves more instructors to small training of oral teaching. Small elegance of oral class is conducted in accordance with the colleges of expert natural training, each elegance is up to no more than forty humans. Small class of oral instructions cognizance on training students' English talking potential. the sort of small class oral elegance allows teachers to understand each pupil's English skillability and person, appreciate for man or woman differences within the coaching system, to create the situations to play each of the students' English getting to know capacity. Stimulate and increase college students' interest in getting to know to broaden their independent getting to know capacity.

precise overall performance of the take a look at way of assessment of teaching effectiveness for the test, check wash back impact on teaching. in the course of our diverse English examinations, tough to locate language output of the venture become no longer given ok interest. these examinations are basically only to emphasize the form of language (together with vocabulary, grammar) and the language input of the check. we will see that the modern-day exam machine and form is one of the purpose of English teaching in India dumb English, time-consuming inefficient" problem. therefore, I proofread English take a look at to make the reforms. university English as an unbiased discipline, set up a separate oral exam. limited because of modern conditions, the oral exam shape with the aid of study room instructors as examiners teacher with an English instructor to finish assessment of the oral achievement of college students for a semester. The oral exam for the whole semester exercise topic. additional university English examinations, however additionally to make students pay more attention to the spoken language training. So that once 4 semesters of spoken language schooling, are concerned in all aspects of day by day existence are the subject of students in English to express, significantly enhancing the students' English oral communication competence.

As classroom teachers worried within the reform, we have to first clean the one-of-a-kind roles performed with the aid of teachers inside the magnificence of "extensive" and "spoken". conspicuously look at and college English guides teaching requirements (Trial) ", emancipate our minds, exchange their thoughts. teachers what to teach "to how to train in-

depth discussions, re-alter the location of instructors and college students. Create a teaching version to "teachers led the scholars as the primary activities. Are short oral coaching techniques presently used by the college. inside the oral school room, every so often the entire class together to discuss, and from time to time each group to speak about a problem, and then for the elegance to explain his own factor of view; now and again teams will examine outcomes in their discussions, analyze and summarize the similarities and variations, and students improvise speak, the closing teacher to summarize. earlier than the dialogue of an problem, instructors are given first with this subject matter-related vocabulary, terms and sentences to facilitate scholar discussion. dialogue, calls for that every speaker can't simply speaking to themselves, but to talk for the preceding comment, recommend their perspectives, to give an explanation for his very own perspectives, now not most effective so that each student can focus on the students mutual studying and train us to control the necessities of the language, and additionally contributed to the improvement of college students' questioning competencies and manipulate language capacity, with a view to lay a very good basis to further improve oral.

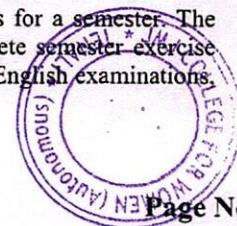
In addition, which will acquire the suitable pronunciation and intonation, college students should be a number of mechanical oral drills. but, a unmarried exercise within the shape and rhythm is easy to make them experience boring, teachers need to keep to trade teaching methods to attract students' interest and make them feel clean and exciting, so as to mobilize the enthusiasm of students. as an example, do tongue-twisters, oral messenger and taught to sing simple songs in English and different verbal sport; performances into the classroom, instructors within the lecture room as a stage, mentoring college students play, led by using the spirit of coaching and studying as the main training the main line of the precept of ; encourage students to talk English story; association of oral job. prepare college students to take part in a variety of extracurricular English mastering activities. We organized the English nook, dormitories, English, English salon, English speech contest and different sports. as a way to ensure that the consequences of extra-curricular sports, the implementation of the gadget of coaching assistants, is the speaker teachers with coaching assistants, to help teachers' agencies and guide college students in extra-curricular mastering sports. via the common efforts of teachers and students, faculty university English coaching has stepped forward remarkably, the scholars' main Mobility and learning appreciably stepped forward, and laid a good foundation for the in-depth

development of the college English teaching reform.

#### REFORM OF THE CLASS TYPE

English education instructors is the shortage of a common hassle of the national higher training, in particular after the university enrollment in 1999, the shortage of instructors of English coaching is extra apparent. Our school isn't always any exception, is also managing this situation. this example, expertise promote the university English training reform? Use of existing teachers, English magnificence reform, a big beauty of intensive analyzing route in small education on oral magnificence. big reading course focuses on the of the language input, and consciousness on schooling university students' English capability, and took big instructions taught within the form of about 200. Lectures impact so that you can make sure the students' use of multimedia to large instructions taught English instructions. this saves extra instructors to small lessons of oral coaching. Small elegance of oral elegance is carried out according with the schools of professional herbal education, every elegance is as lots as no more than 40 humans. Small class of oral classes attention on training college students' English talking capability. this type of small elegance oral magnificence allows instructors to apprehend each student's English skillability and character, recognize for character variations in the coaching technique, to create the situations to play every of the students' English getting to know capability. Stimulate and growth students' interest in mastering to increase their impartial getting to know functionality.

Precise standard overall performance of the take a look at technique of evaluation of training effectiveness for the take a look at, test wash again impact on coaching. within the direction of our various English examinations, hard to locate language output of the mission grow to be not given good enough attention. the ones examinations are basically simplest to emphasise the form of language (together with vocabulary, grammar) and the language enter of the check. we can see that the modern-day examination gadget and form is one of the reason of English training in India dumb English, time-eating inefficient" trouble. consequently, I proofread English test to make the reforms. college English as an unbiased subject, installation a separate oral exam. constrained because of modern-day conditions, the oral exam form through way of study room teachers as examiners trainer with an english teacher to complete evaluation of the oral achievement of college students for a semester. The oral examination for the complete semester exercise subject matter. extra university English examinations.





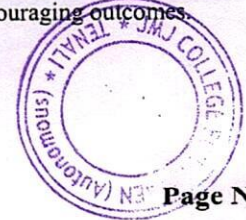
understanding ever knowledge also to make students pay greater hobby to the spoken language training. So that once 4 semesters of spoken language training, are worried in all components of daily existence are the challenge of students in English to explicit, extensively improving the students' English oral communicate competence.

As classroom instructors involved within the reform, we need to first easy the distinct roles carried out by using teachers within the class of "widespread" and "spoken". conscientiously take a look at and university English courses coaching necessities (Trial)", emancipate our minds, alternate their ideas. teachers what to educate "to" a way to knowledge teach in-depth discussions, re-alter the place of teachers and college students. Create a training model to "instructors led the students because the principle activities. Are quick oral training techniques presently utilized by the college. in the oral classroom, once in a while the entire elegance collectively to speak about, and from time to time every organization to talk about a trouble, and then for the magnificence to provide an explanation for his private element of view; from time to time groups will examine consequences of their discussions, look at and summarize the similarities and variations, and students improvise communicate, the final instructor to summarize. earlier than the dialogue of an trouble, teachers are given first with this problem depend-related vocabulary, terms and sentences to facilitate scholar discussion. discussion, requires that each speaker cannot honestly talking to themselves, information to talk for the preceding remark, put forward their views, to provide an cause of his own views, not simplest in order that every student can cognizance on the students mutual gaining knowledge of and train us to manipulate the essentials of the language, and moreover contributed to the development of university students' questioning capabilities and manipulate language ability, so one can lay a terrific foundation to in addition decorate oral.

in addition, a good way to accumulate the perfect pronunciation and intonation, students need to be a number of mechanical oral drills. know knowledge, a single exercise inside the shape and rhythm is easy to lead them to feel uninteresting, teachers need to hold to change teaching techniques to attract college students' attention and cause them to enjoy clean and thrilling, as a way to mobilize the passion of students. for instance, do tongue-twisters, oral messenger and taught to sing smooth songs in English and special verbal recreation; performances into the study room, instructors within the school room as a degree, mentoring college students play, led through the spirit of teaching and getting to know because the

precept education the principle line of the principle of ; inspire students to talk English tale; association of oral procedure. arrange university students to take part in a diffusion of extracurricular English reading sports. We organized the English Comer, dormitories, English, English salon, English speech contest and other sports. so that it will ensure that the outcomes of extra-curricular activities, the implementation of the gadget of coaching assistants, is the speaker instructors with coaching assistants, to help teachers' companies and manual college students in extra-curricular learning activities. via the common efforts of teachers and students, college university English training has advanced remarkably, the students' primary Mobility and studying extensively improved, and laid a notable basis for the in-intensity development of the university English coaching reform.

Excellent trouble in the university English coaching may be summarized as dumb English, time-ingesting and inefficient. most people of English newbie's analyze English for the motive that junior high college (now there are various regions from the second and 1/3 grade) high faculty for 6 years mastering English, maximum enter university for further studies, and years of formal English schooling (English professional for 4 years), and some admitted to graduate college understanding additionally study English, or maybe PhD, continues to be getting to know English. Up to ten-12 years of English gaining knowledge of, non-public of beginners still fluently speak English loose oral expression, the so-known as "dumb English". part of the learner check, gets excessive marks, expertise real software functionality, interpersonal abilities are very bad. The crux of the dumb english, is an excessive amount of emphasis on test-taking capabilities and language capabilities of English, to the forget about of the cultivation of interpersonal competencies. With the of domestic and overseas pupils on the nature of language communication, inter capabilities training has grow to be an essential a part of overseas language coaching. university English coaching is an imperative a part of college training, it's miles a group of a diffusion of teaching models and coaching techniques as one, language understanding and language abilities, studying techniques and intercultural conversation as the precept content of the teaching tool, university english teaching reform is a systematic undertaking. for the reason that 2000, the school accomplished a series of college english teaching exercise and research paintings, especially in college oral English education a series of reforms and attempt to accumulate encouraging outcomes.



### THEREFORMOFTEACHINGMETHODS

Over the years, my school only opened the "college English" courses will concentrate to English language teaching, speaking, studying, writing and translating integration. affected by the way of the traditional take a look at, the academics in the coaching technique only attention on education college students' listening, studying, writing, translation of the ability of four aspects of the forget about of the spoken language capability, resulting within the phenomenon of the dumb English. Order to get out of the plight of the dumb english, to broaden college students 'oral verbal exchange ability to adapt to the new requirements of the social development of university students' English ability, for the reason that 204 beginners, the implementation of the college English curriculum reform. similarly to the advent of the unique college English courses, additionally opened a college english direction. Oral route opened a total of four semesters, every semester for 32 hours in keeping with week, oral class. Open oral lessons to essentially exchange tendency of the conventional university English guides re-written, light verbal exchange.

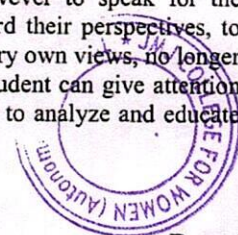
English coaching teachers is the shortage of a commonplace problem of the country wide better education, especially after the university enrollment in 1999, the shortage of instructors of English coaching is more obvious. Our faculty is not any exception, is also going through this example. this example, how to promote the university English coaching reform? Use of existing instructors, english class reform, a big class of intensive studying path in small lessons on oral elegance. intensive reading course makes a specialty of the knowledge of the language enter, and consciousness on training college students' English capability, and took huge training taught within the shape of about 200. Lectures impact so as to make sure the students' use of multimedia to massive training taught English lessons. this protects greater instructors to small lessons of oral teaching. Small elegance of oral elegance is performed in accordance with the colleges of professional natural classes, every magnificence is up to no extra than forty human beings. Small elegance of oral training focus on schooling college students' english talking ability. this kind of small magnificence oral elegance allows teachers to recognize each pupil's English skill ability and person, recognize for individual variations in the coaching method, to create the situations to . play each of the students' English mastering potential. Stimulate and expand students' interest in learning to develop their unbiased getting

to know ability. unique carry out . Mance of the check approach of evaluation of coaching effectiveness for the test, take a look at wash again effect on coaching. for the duration of our diverse English examinations, difficult to locate language output of the project turned into no longer given ok interest. those examinations are essentially simplest to emphasize the shape of language (consisting of vocabulary, grammar) and the language enter of the test.

consequently, I proofread English take a look at to make the reforms. college English as an unbiased subject, set up a separate oral exam. confined because of modern-day conditions the oral exam from by way of classroom teachers as examiners teacher with an English trainer to finish the assessment of college students for a semester spoken educational. The oral exam for the whole semester practice topic. additional college English examinations, but also to ma . okay: college students pay more interest to the spoken language schooling. So .that once 4 semesters of spoken language education, are worried in all elements of every day existence are the topic of students in English to express, greatly improving the students' English oral communication competence.

As lecture room teachers worried within the reform, we should first clear the exceptional roles played with the aid of teachers within the elegance of "intensive" and "spoken". rigorously take a look at and college English guides coaching requirements (Trial) ",emancipate our minds, alternate their thoughts. instructors what to instructor "to" the way to teach in-depth discussions, re-regulate the location of instructors and students. Create a coaching model to "teachers led the students as the primary sports. Are short oral teaching methods presently utilized by the faculty. within the oral classroom, sometimes the complete elegance collectively to talk about, and now and again each organization to talk about a trouble, and then for the class to explain his own factor of view' every now and then groups will compare consequences of their discussions: examine and summarize the similarities and variations and college students improvise communicate, the ultimate teacher to summarize. earlier than the dialogue of an problem, teachers are given first with this subject matter-related vocabulary, phrases and sentences to facilitate scholar discussion.

dialogue, calls for that every speaker cannot simply speaking to themselves, however to speak for the preceding remark, put forward their perspectives, to give an explanation for his very own views, no longer handiest in order that each student can give attention to the scholars each different to analyze and educate



the manipulate of the essentials of the language, but additionally to sell the improvement of students' wondering competencies and manage language capabilities, so that it will lay a terrific foundation for the further improvement of oral. further, on the way to obtain the precise pronunciation and intonation, college students must be some of mechanical oral drills. but, a unmarried practice inside the form and rhythm is easy to cause them to feel dull, teachers must preserve to change coaching strategies to attract college students' attention and lead them to experience fresh and interesting, with a view to mobilize the passion of college students.

as an instance, do tongue-twisters, oral messenger and taught to sing simple songs in English and other verbal sport; performances into the classroom teachers inside the . lecture room as a stage, mentoring college students play: led through the . spirit of coaching and getting to know as the primary schooling the principle line of the principle of inspire college students to talk English tale; arrangement of oral activity. organize students to take part in a spread of extracurricular english learning sports. We organized the english Comer, monitories' English, English salon, English speech contest and other; activities. a good way to make sure that the outcomes of extracurricular activities, the implementation of the device of coaching assistants, is the speaker instructors with teaching assistants, to assist teachers' businesses and manual college students in extra-curricular gaining knowledge of activities. The joint efforts of instructors and college students, faculty, university oral English teaching has stepped forward remarkably and drastically stepped forward students' motivation to learn and learning, and laid a very good foundation for in-intensity improvement of the university english coaching reform.

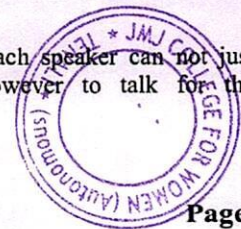
#### REFORM OF THE CLASS TYPE

As As lecture room instructors worried in the reform, we should first clean the one-of-a-kind roles performed through instructors within the magnificence of "in depth" and "spoken". rigorously have a look at and university English courses teaching necessities (Trial) ", emancipate our minds, trade their ideas. instructors what to teach "to" a way to train in-depth discussions, re-modify the location of teachers and college students. Create a coaching model to "teachers led the students as the principle sports. Are quick oral teaching techniques presently used by the faculty. within the oral classroom, occasionally the entire class together to talk about, and once in a while each institution to talk about a

problem, after which for the magnificence to give an explanation for his personal point of view' once in a while teams will evaluate outcomes in their discussions: examine and summarize the similarities and differences and college students improvise communicate, the ultimate teacher to summarize. earlier than the discussion of a problem, teachers are given first with this topic-associated vocabulary, phrases and sentences to facilitate scholar dialogue. discussion, calls for that every speaker cannot just speaking to themselves, however to speak for the previous comment, put forward their perspectives, to provide an explanation for his very own views, no longer best so that each pupil can give attention to the students mutual learning and educate us to control the essentials of the language, and also contributed to the improvement of students' thinking capabilities and control language capability, on the way to lay an amazing foundation to further improve oral.

similarly, so that it will achieve the perfect pronunciation and intonation, students ought to be some of mechanical oral drills. but, a unmarried exercise inside the shape and rhythm is straightforward to cause them to experience dull, instructors should keep to trade teaching strategies to draw college students' attention and lead them to sense fresh and thrilling, so that it will mobilize the enthusiasm of college students. as an example, do tongue-twisters, oral messenger and taught to sing simple songs in English and different verbal game; performances into the school room teachers inside the study room as a degree, mentoring college students play: led through the spirit of coaching and getting to know as the primary schooling the main line of the principle of ; inspire students to talk English story; arrangement of oral activity. organize students to take part in an expansion of extracurricular English gaining knowledge of activities. We organized the English Comer dormitories, English, English salon, English speech contests and other activities. so as to ensure that the consequences of extra-curricular activities, the implementation of the gadget of coaching assistants, is the speaker instructors with coaching assistants, to help instructors' agencies and manual students in extra-curricular mastering activities. thru the not unusual efforts of instructors and students, college university English coaching has stepped forward remarkably, the students' primary Mobility and studying substantially advanced, and laid a great foundation for the in-intensity development of the university English teaching reform.

discussion, calls for that each speaker can not just talking to themselves, however to talk for the



previous comment, recommend their views, to explain his own views, now not only so that every student can focus on the scholars each different to research and train the manipulate of the essentials of the language, but additionally to sell the development of college students' thinking capabilities and manage language abilities, so as to lay a great basis for the further development of oral. similarly, with a view to achieve the precise pronunciation and intonation, students must be a number of mechanical oral drills. but, a single practice inside the form and rhythm is simple to cause them to feel dull, teachers should continue to exchange coaching techniques to draw college students' attention and cause them to feel sparkling and thrilling, so that it will mobilize the passion of students. for instance, do tongue-twisters, oral messenger and taught to sing easy songs in English and different verbal sport; performances into the school room instructors within the school room as a stage, mentoring college students play: led through the spirit of teaching and gaining knowledge of as the main schooling the principle line of the precept of inspire students to talk English story; arrangement of oral process. prepare college students to take part in a diffusion of extracurricular english learning sports. We prepared the english Comer, dormitories, English, English salon, English speech contest and other sports. which will make sure that the outcomes of extracurricular activities, the implementation of the gadget of coaching assistants, is the speaker teachers with teaching assistants, to help instructors' groups and guide college students in more-curricular gaining knowledge of activities. The joint efforts of instructors and college students, college, college oral English teaching has stepped forward remarkably and drastically stepped forward students' motivation to study and mastering, and laid an amazing basis for in-depth improvement of the university english teaching reform.

#### CONCLUSION

Principal essential penalty five and extra punishment of 3 varieties of penalties prescribed by way of the criminal regulation of China. From the prevailing case, the penalty's deterrent and shielding sufficient. laptop and cyber crime frame general fascination with this form of crime, punishment after the crime took place typically to prevent criminal acts from happening once more, so the introduction of new types of penalties is especially vital. Eligible for punishment may be protected in India's penal gadget, as new kinds of penalties. Eligible for punishment including the general public authority, parental authority and occupational deprivation of the proper. laptop and cyber crime as a excessive-tech profession crook set or offer disadvantaged in their expert

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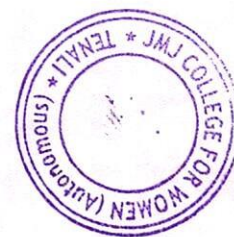
qualification in computer and networking industry, will play a totally prominent function within the containment and prevention of crime.

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# Erbium doped Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> glass-ceramics containing Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and CaF<sub>2</sub> nanocrystallites for 1.53 μm fiber lasers

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Gain parameters

## ABSTRACT

Trivalent erbium ions doped Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> transparent glass ceramics containing CaF<sub>2</sub> were prepared and characterized through X-ray diffraction, scanning electron microscopy, Fourier transform infrared absorption, optical absorption, and near infrared emission for 1.53 μm fiber lasers. The glass ceramics obtained by applying thermal treatment at 575 °C for 5 h and 575 °C for 10 h contain Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and CaF<sub>2</sub> crystallites. The Judd-Ofelt theory was applied to evaluate various spectroscopic and laser characteristic properties. The NIR emission corresponding to the <sup>4</sup>I<sub>13/2</sub> → <sup>4</sup>I<sub>15/2</sub> (~1.53 μm) transition was studied by exciting the samples at 514.5 nm laser radiation. The stimulated emission cross-sections of ~1.53 μm luminescence were also obtained applying the McCumber theory. The experimental results confirm that the transparent glass ceramic obtained at a thermal treatment of 575 °C for 10 h is more suitable to design fiber lasers for diverse applications in the fields of industry, medicine and scientific research.

## 1. Introduction

Transparent glass ceramics (GCs) find extensive applications in the fields of vacuum technology, photonics, electronics, communication, biomedicine etc., owing to their thermal, mechanical, optical and physical properties compared to their host glasses [1–3]. Usually, they are polycrystalline materials containing nanometer to micrometer size crystallites embedded in a residual glass matrix and they are generally produced by controlled crystallization mechanism of appropriate glassy materials. Among all the available solid state lasers containing trivalent rare earth (RE) ions, the oxyfluoride GCs are more suitable for realistic applications owing to their low phonon energy, excellent chemical durability and good mechanical strength [4,5]. Recently, glasses and GCs containing Bi<sub>2</sub>O<sub>3</sub> have attained great attention due to their high density, high refractive index, extended transmission in mid-IR, high dielectric constant and high polarizability [6,7]. The non-linear response to the incident light exhibited by these materials is a function of electronic polarizability of their constituents. Thus, the electronic polarizability is one of the significant parameters of luminescent materials for optical and electro-optic applications [8,9].

Usually, the boron atom coordinated with either three or four oxygen atoms forming two fundamental BO<sub>3</sub> and BO<sub>4</sub> structural units and they can be combined to form different B<sub>x</sub>O<sub>y</sub> structural groups. Borate glasses containing heavy metal oxides such as Bi<sub>2</sub>O<sub>3</sub>, TeO<sub>2</sub>, PbO

or ZnO have received special interest due to their possible applications as solid state lasers and electro-optic modulators [10,11]. It is known that the Bi<sub>2</sub>O<sub>3</sub> does not form glass by itself due to high polarizability of bismuth ions and the variation in coordination number of Bi<sup>3+</sup> ions. Thus, Bi<sub>2</sub>O<sub>3</sub> exists in the glass network as BiO<sub>3</sub>, BiO<sub>4</sub> and BiO<sub>6</sub> pyramids in the presence of conventional glass formers such as SiO<sub>2</sub>, B<sub>2</sub>O<sub>3</sub>, P<sub>2</sub>O<sub>5</sub> etc. Further depending on the composition of Bi<sub>2</sub>O<sub>3</sub> and B<sub>2</sub>O<sub>3</sub>, the bismuth borate based crystals, glasses and glass ceramics show tunable optical properties in a wide range. The Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> system forms different types of phases such as BiBO<sub>3</sub>, Bi<sub>2</sub>B<sub>8</sub>O<sub>15</sub>, BiB<sub>3</sub>O<sub>6</sub>, Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub>, Bi<sub>4</sub>B<sub>2</sub>O<sub>9</sub> and Bi<sub>24</sub>B<sub>2</sub>O<sub>39</sub> [12]. Among these the Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and Bi<sub>4</sub>B<sub>2</sub>O<sub>9</sub> phases are more stable while the BiBO<sub>3</sub>, Bi<sub>2</sub>B<sub>8</sub>O<sub>15</sub> and BiB<sub>3</sub>O<sub>6</sub> phases exhibit polymorphism. These results lead to investigate the applicability of Bi<sub>2</sub>O<sub>3</sub>-B<sub>2</sub>O<sub>3</sub> system for optical fiber lasers.

The oxyfluoride GCs exhibit excellent optical properties over the glasses and crystals when doped with RE ions. The luminescent properties of various trivalent RE ions activated GCs have been intensively investigated [13–16]. The Er<sup>3+</sup>-doped multi-component glasses are more common as broad band amplifiers such as short-wavelength band (S-band: 1.480–1.520 μm), conventional band (C-band: 1.530–1.563 μm) and long-wavelength band (L-band: 1.570–1.610 μm) in telecommunication. The far-infrared emission through Er<sup>3+</sup>: <sup>4</sup>I<sub>11/2</sub> → <sup>4</sup>I<sub>13/2</sub> (~2.70 μm), near-infrared (NIR) emission through Er<sup>3+</sup>: <sup>4</sup>I<sub>13/2</sub> → <sup>4</sup>I<sub>15/2</sub> (~1.53 μm) and visible emission through Er<sup>3+</sup>: <sup>4</sup>S<sub>3/2</sub> → <sup>4</sup>I<sub>15/2</sub>

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( $\sim 0.54 \mu\text{m}$ ) are useful in the fields of industry, medicine, scientific research, etc. The luminescent materials containing  $\text{Er}^{3+}$  ions find extensive applications as waveguide fiber amplifiers, optical fiber lasers and waveguide division multiplexing. In literature, large number of reports are available on  $\text{Er}^{3+}$  activated multi-component glasses, however, a least number of studies have been reported for  $\text{Er}^{3+}$ -doped oxyfluoride GCs for optical fiber lasers [1,17,18]. Hence, there is a need to identify, design and develop a new class of transparent oxyfluoride GCs. In this research work the preparation, structural, morphological and optical analysis of 1.0 mol%  $\text{Er}^{3+}$ -doped  $\text{Bi}_2\text{O}_3\text{-B}_2\text{O}_3\text{-CaF}_2$  glasses (BiBCEr-G) and glass ceramics (BiBCEr-GC) have been explored in detail. The optical analysis includes the estimation of emission cross-sections applying the Judd-Ofelt [19,20] and Mc Cumber [21] theories.

## 2. Experimental techniques

### 2.1. Materials and preparation method

Trivalent erbium ( $\text{Er}^{3+}$ ) doped bismuth borate transparent glass ceramics containing  $\text{CaF}_2$  were synthesized by conventional melt-quenching procedure and by thermal treatment with chemical composition:  $71.25 \text{ Bi}_2\text{O}_3 + 17.75 \text{ B}_2\text{O}_3 + 10.00 \text{ CaF}_2 + 1.00 \text{ ErF}_3$  using  $\text{Bi}_2\text{O}_3$  (99%, Sigma Aldrich),  $\text{H}_3\text{BO}_3$  (99.5%, Merk),  $\text{CaF}_2$  (99.99%, Sigma Aldrich) and  $\text{ErF}_3$  (99.99%, Sigma Aldrich). An excess of 5.0 wt% of  $\text{H}_3\text{BO}_3$  was added to compensate its evaporation during melt process. About 25 g batch of homogeneous powders are taken in alumina crucible and heat treated at  $300^\circ\text{C}$  for 5 h and then melted for at  $1000^\circ\text{C}$  30 min. The melt was air quenched using a preheated-brass mould, annealed at  $400^\circ\text{C}$  for 20 h and then cooled to room temperature. The prepared glass samples (BiBCEr-G) are heat treated at various temperatures for different time i.e.,  $550^\circ\text{C}$  for 20 h,  $560^\circ\text{C}$  for 10 h,  $575^\circ\text{C}$  for 5 h and  $575^\circ\text{C}$  for 10 h and referred as BiBCEr-GC1, BiBCEr-GC2, BiBCEr-GC3 and BiBCEr-GC4, respectively. It was found that the samples heat treated at  $575^\circ\text{C}$  and  $560^\circ\text{C}$  for more than 10 h became opaque. All the samples were polished for good optical quality and characterized for fiber laser applications. A schematic representation of method of preparation of glass and glass-ceramics is shown in Scheme 1.

### 2.2. Optical characterization

The crystallization temperature ( $T_c$ ) and the glass transition temperature ( $T_g$ ) were identified from the differential thermal analysis (DTA) analysis carried out with Shimadzu DTG-60H DTA-TG under  $\text{N}_2$  atmosphere at a heating rate of  $10^\circ\text{C}/\text{min}$ . The powder X-ray diffraction (XRD) studies were carried out with RIGAKU Miniflex-600 X-ray diffractometer provided with  $1.5406 \text{ \AA}$   $\text{CuK}\alpha 1$  radiation. The Fourier transform infrared (FTIR) analysis was carried out with PerkinElmer Spectrum one: FT-IR spectrometer following KBr technique. The scanning electron microscopic (SEM) images and energy dispersive X-ray (EDX) analysis were carried out with Hitachi SU-70 High Resolution SEM equipped with BrukerQuantax EDX. The absorption studies were

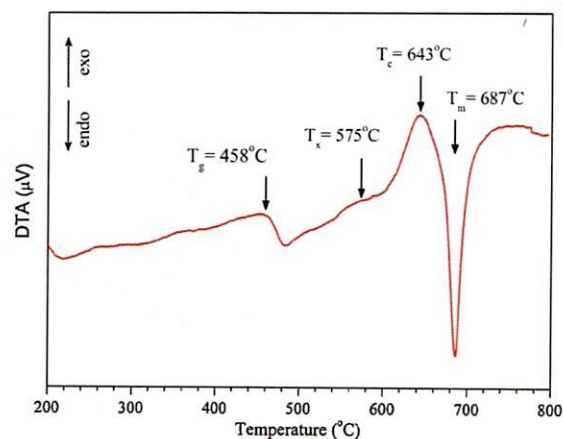


Fig. 1. DTA profile of BiBCEr-G powder.

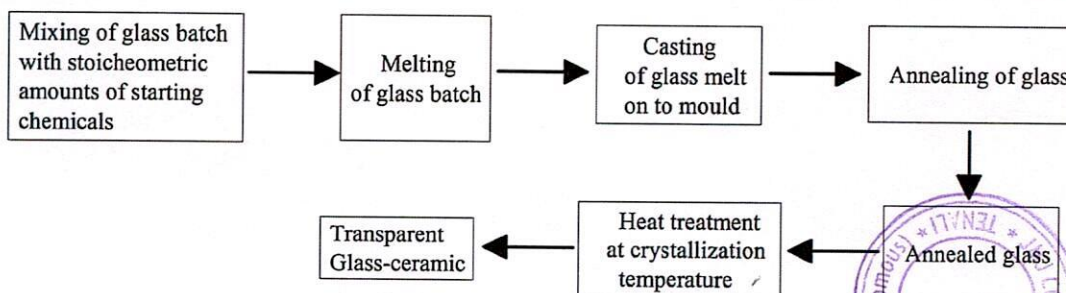
carried out with PerkinElmer Lambda 950 spectrometer. The near infrared (NIR) emission analysis was carried out with TRIAX 550 monochromator and GaAs photodetector using  $514.5 \text{ nm}$  Laser. The excited state dynamics were carried out with SDL-980-LM6000 T apparatus using  $980 \text{ nm}$  Laser. All the measurements were carried out at normal temperature.

## 3. Results and discussion

### 3.1. Thermal and some basic properties

The DTA curve of as prepared BiBCEr-G shown in Fig. 1 consists of an exothermic peak at about  $458^\circ\text{C}$  representing the glass transition temperature ( $T_g$ ). Two more exothermic peaks at about  $575^\circ\text{C}$  and  $643^\circ\text{C}$  correspond to on-set ( $T_x$ ) and bulk ( $T_c$ ) crystallization temperatures, respectively. The on-set crystallization peak is attributed to the precipitation of  $\text{Bi}_3\text{B}_5\text{O}_{12}$  and  $\text{CaF}_2$  crystals and the bulk crystallization peak is ascribed to the formation of  $\text{Bi}_3\text{B}_5\text{O}_{12}$  phase. The sharp and deep endothermic peak at around  $687^\circ\text{C}$  indicates the melting temperature ( $T_m$ ) of  $\text{Bi}_3\text{B}_5\text{O}_{12}$  phase. The temperature difference of  $\sim 68^\circ\text{C}$  between  $T_x$  and  $T_c$  reveals the formation of  $\text{CaF}_2$  nanocrystallites in BiBC glass matrix.

The temperature difference of  $\sim 117^\circ\text{C}$  between  $T_x$  and  $T_g$  indicates that the studied samples have high thermal stability ( $\Delta T = T_x - T_g$ ). Further, higher the Herby number ( $H = \frac{T_c - T_g}{T_m - T_c}$ ) more is the glass forming tendency [22]. The observed values of  $\Delta T$  and  $H$  are found higher than TWG [23] and PBTNAPrO [24] glasses. Considerably higher values of  $\Delta T$  and  $H$  reveal that the studied materials show high thermal stability and excellent glass forming behaviour and they are more favourable to draw fibers for various applications. Some of the basic properties such as mass density ( $\rho$ ), index of refraction ( $n$ ), dielectric constant ( $K$ ), reflection losses ( $R$ ) and concentration of  $\text{Er}^{3+}$  ions have been evaluated and they are summarized in Table 1. Necessary



Scheme 1. Representation of method of preparation of glass and glass-ceramics.

**Table 1**

Sample thickness ( $t \pm 0.001$  cm), density ( $\rho \pm 0.001$  g-cm<sup>-3</sup>), refractive index ( $n \pm 0.001$ ), dielectric constant ( $K \pm 0.001$ ), reflection losses ( $R \pm 0.001\%$ ), concentration of Er<sup>3+</sup> ions ( $N \pm 0.006 \times 10^{19}$  ions-cm<sup>-3</sup>) and optical band gap energy ( $E_{opt} \pm 0.001$  eV), for BiBCEr glass and glass ceramics.

Property	BiBCEr-G	BiBCEr-GC1	BiBCEr-GC2
t	0.140	0.140	0.140
$\rho$	4.828	4.859	4.923
n	1.855	1.863	1.875
K	3.441	3.471	3.516
R	8.968	9.086	9.263
N	8.040	8.091	8.198
$E_{opt}$	2.762	2.731	2.702

formulae to evaluate these properties have been mentioned in our previous work [23].

### 3.2. XRD, SEM and EDAX analysis

To analyze the crystalline phase of synthesized BiBCEr glass and glass ceramics, the powder XRD measurements were carried out and shown in Fig. 2a. The absence of diffraction peaks in XRD profile of BiBCEr-G reveals its typical amorphous nature. Non-existence of diffractions peaks in BiBCEr-GC1 indicates that the formation of crystalline phase, if any, is negligible. The XRD patterns of BiBCEr-GC2, BiBCEr-GC3 and BiBCEr-GC4 indicate that the intensity of diffraction peaks increase with the increase of temperature and time of heat treatment. The XRD profiles of BiBCEr-GC3 and BiBCEr-GC4 exhibit amorphous as well as crystalline (Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and CaF<sub>2</sub>) phases. The Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> crystalline phase is well consistent with the JCPDS Card No. 29-0228 and it has an orthorhombic structure with space group Pnma, Z = 8, and cell parameters: a = 6.530 Å, b = 7.726 Å, c = 18.578 Å [25]. The Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> crystals have been identified as non-linear optical medium for solid-state lasers [26]. The XRD profile of BiBCEr-GC4 in the range 25° < 2θ < 30° shown in Fig. 2b clearly indicates the formation of CaF<sub>2</sub> nanocrystals in BiBCEr-GC4 [14].

The diffraction peak at 2θ = 27.86° belongs to the (1 1 1) plane of CaF<sub>2</sub> cubic phase. From the obtained values of full width at half maximum of XRD profiles, the average crystallite size ( $D_{hkl}$ ) of Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and CaF<sub>2</sub> nanocrystals has been calculated by the Debye-Scherrer's formula:

$$D_{hkl} = \frac{0.89 \lambda}{\beta_{2\theta} \cos \theta} \quad (1)$$

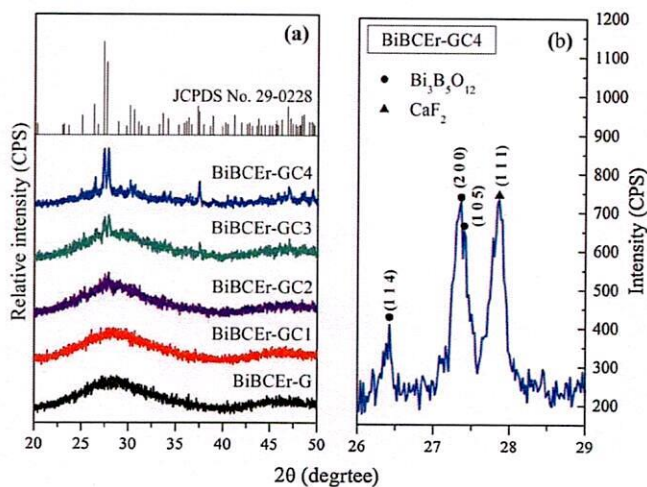


Fig. 2. XRD profiles of BiBCEr-G and BiBCEr-GCs (a) and the magnified XRD profile of BiBCEr-GC4 in 2θ range from 26° to 29° (b).

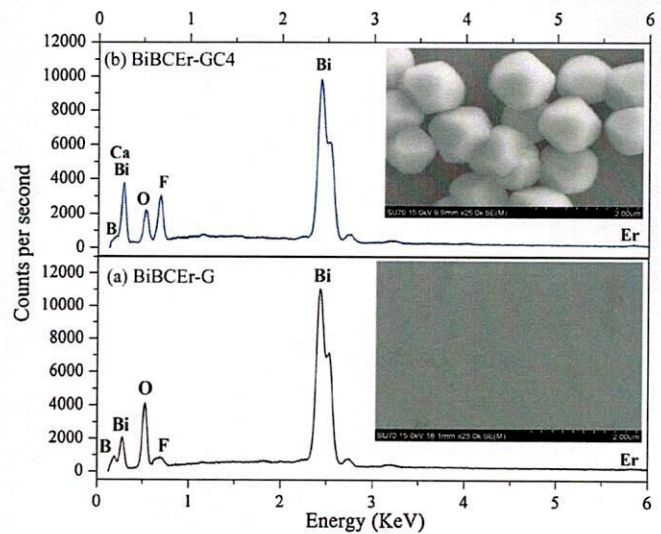


Fig. 3. EDAX profiles along with SEM images for BiBCEr-G (a) and BiBCEr-GC4 (b).

where  $\lambda$  is the wavelength of X-rays (1.5406 Å),  $\beta_{2\theta}$  is the full-width at half maximum and  $\theta$  is the angle of diffraction. In order to determine the average crystallite size, the full-width at half maximum of the high intense diffraction peak corresponding to the (2 0 0) plane in Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and (1 1 1) plane in CaF<sub>2</sub> was used. The size of CaF<sub>2</sub> and Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> crystallites is estimated to be 37 nm and 40 nm, respectively.

To understand the morphology and the presence of elements, the SEM image with EDX was recorded for BiBCEr-G and BiBCEr-GC4 that were etched in 2 wt% of HF solution for 45 s and they are illustrated in Fig. 3. The SEM image of BiBCEr-G (see Fig. 3a) reveals the absence of microstructures related to the glassy/amorphous phase. The SEM image of BiBCEr-GC4 (see Fig. 3b) describes the homogeneously distributed crystallites of nearly 1.0 μm in size. From the EDX profile of BiBCEr-GC4, one can notice that each crystallite contains the elements: boron (B), bismuth (Bi), calcium (Ca), oxygen (O) and fluorine (F), indicating the agglomeration of both Bi<sub>3</sub>B<sub>5</sub>O<sub>12</sub> and CaF<sub>2</sub> crystallites surrounded by the glassy phase. These results are harmonic with those obtained from the XRD profiles.

### 3.3. FTIR analysis

The FTIR spectra of BiBCEr-G and BiBCEr-GC4 in the spectral region from 4000 cm<sup>-1</sup> to 400 cm<sup>-1</sup> are shown in Fig. 4. From these spectra one can notice a good resemblance between the IR spectra of BiBCEr-G and BiBCEr-GC4 reflecting the existence of identical structural units. It is renowned that the concentration of the structural group has been considered to be proportional to the relative area of its component band.

The IR absorption band located at around 3466 cm<sup>-1</sup> has been ascribed to the symmetric stretching vibrations of OH<sup>-</sup> group [27]. The coefficient of OH<sup>-</sup> content is estimated to be 165.99 and 69.76 (± 0.02) ppm for BiBCEr-G and BiBCEr-GC4, respectively [28]. The magnitude of OH<sup>-</sup> content of BiBCEr-GC4 sample is close to PBTNAPr (66.81 ppm) [24] and ZnAlBiB (65.48 ppm) [29]. Reasonably small magnitude of coefficient of OH<sup>-</sup> content reveals that the studied materials are suitable for fiber lasers. The characteristic features of BiBCEr-G and BiBCEr-GC4 are the asymmetric-stretching vibrations of B–O bonds from the orthoborate group at around 1340 cm<sup>-1</sup>, the B–O stretching-vibrations in BO<sub>3</sub> units at around 1223 cm<sup>-1</sup>, the B–O stretching-vibrations in BO<sub>4</sub> units from tri-, tetra- and penta-borate groups at around 1086 cm<sup>-1</sup>, the B–O stretching-vibrations in BO<sub>4</sub> units from di-borate groups at around 922 cm<sup>-1</sup>, the bending-vibrations of B–O–B linkage in the borate network at around 685 cm<sup>-1</sup> and

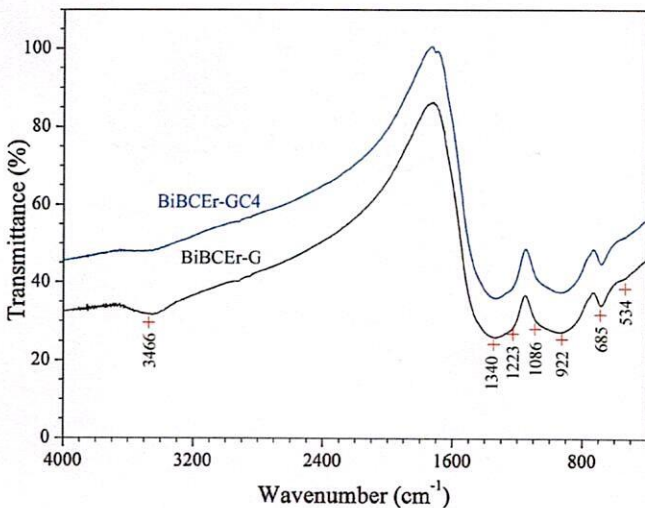


Fig. 4. FTIR profiles for BiBCEr-G and BiBCEr-GC4.

the Bi-O bending-vibration in BiO<sub>6</sub> units at around 534 cm<sup>-1</sup> [30–33]. The phonon energy (E<sub>ph</sub>) is one of the noteworthy parameters of luminescent materials which is responsible for the non-radiative losses and it can be obtained from the FTIR spectral profile. The energy equivalent to the highest absorption band of FTIR profile shows the phonon energy. For the studied BiBCEr-G and BiBCEr-GCs, the phonon energy is predicted as ~1334.67 ± 0.93 cm<sup>-1</sup> and it is close to LBTAFer (1310 cm<sup>-1</sup>) [34] and SFB (1350 cm<sup>-1</sup>) [35]. For the Er<sup>3+</sup> free glass sample, the phonon energy is found to be about 1500.00 ± 0.93 cm<sup>-1</sup> (not shown). It is known that the addition of fluoride content reduces the phonon energy of the host matrix resulting to enhance the radiative transitions. Therefore, the BiBCEr-GCs are more suitable to design fiber lasers with relatively low phonon energy.

### 3.4. Judd-Ofelt parameters

The optical absorption spectral profiles of studied samples have been recorded to determine different spectroscopic and the Judd-Ofelt (J-O) intensity parameters. For reference, the absorption spectra of BiBCEr-G, BiBCEr-GC3 and BiBCEr-GC4 are shown in Fig. 5. These spectra reveal seven absorption bands due to <sup>4</sup>I<sub>15/2</sub> → <sup>4</sup>F<sub>7/2</sub> (488 nm), <sup>4</sup>I<sub>15/2</sub> → <sup>2</sup>H<sub>11/2</sub> (521 nm), <sup>4</sup>I<sub>15/2</sub> → <sup>4</sup>S<sub>3/2</sub> (545 nm), <sup>4</sup>I<sub>15/2</sub> → <sup>4</sup>F<sub>9/2</sub> (651 nm), <sup>4</sup>I<sub>15/2</sub> → <sup>4</sup>I<sub>9/2</sub> (798 nm), <sup>4</sup>I<sub>15/2</sub> → <sup>4</sup>I<sub>11/2</sub> (976 nm) and <sup>4</sup>I<sub>15/2</sub>

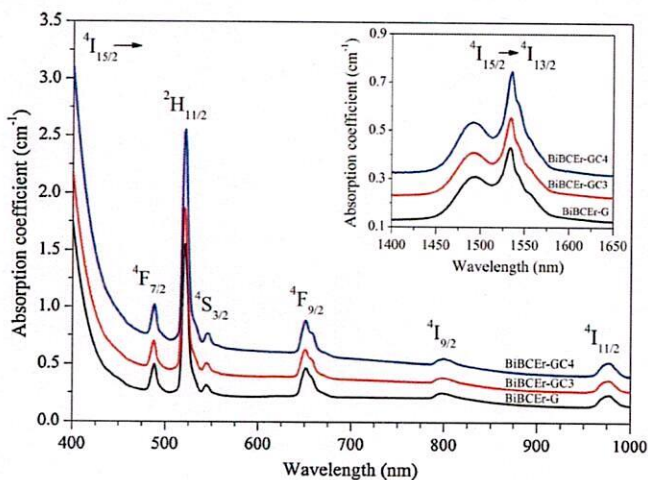


Fig. 5. Absorption spectra of BiBCEr-G, BiBCEr-GC3 and BiBCEr-GC4. Inset shows the absorption spectra in the spectral range 1400–1650 nm.

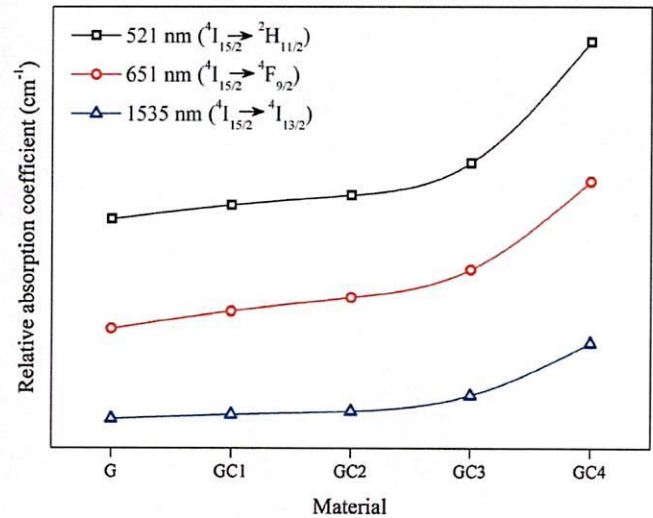


Fig. 6. Absorption coefficient as a function of materials for 521, 651 and 1535 nm bands.

→ <sup>4</sup>I<sub>13/2</sub> (1535 nm) transitions. These spectra also reveal that the strength of absorption bands enhance with the formation of nanocrystallites against the glassy phase. The variation of absorption coefficient versus the nature of material under investigation is shown in Fig. 6.

The strength of absorption band has been estimated in terms of experimentally measured oscillator strengths (*f<sub>exp</sub>*) and they can be evaluated from the integrated area covered by the absorption bands using the equation.

$$f_{exp} = 4.32 \times 10^{-9} \cdot \int_{\nu_1}^{\nu_2} \epsilon(\nu) \cdot d\nu \tag{1}$$

where  $\epsilon(\nu)$  is the molar absorption coefficient of an absorption transition of energy  $\nu$  (in cm<sup>-1</sup>) and it could be determined from the Beer-Lambert principle. According to the Judd-Ofelt [19,20] theory, the theoretically calculated oscillator strength (*f<sub>cal</sub>*) of an absorption transition  $\psi J \rightarrow \psi' J'$  corresponding to energy  $\nu$  is given as

$$f_{cal} = \frac{8\pi^2 m c \nu}{3 h (2J + 1)} \cdot \left[ \frac{(n^2 + 2)^2}{9 n} \cdot S_{ed}(\psi J \rightarrow \psi' J') + n \cdot S_{md}(\psi J \rightarrow \psi' J') \right] \tag{2}$$

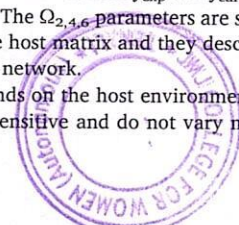
where *m*, *c* and *h* represent the electron mass, speed of light and Planck's constant, respectively. The parameter, *J* represents the total angular momentum of initial  $\psi J$  energy level. *S<sub>ed</sub>* and *S<sub>md</sub>* represents the electric-dipole line-strength and magnetic-dipole line-strength respectively.

$$S_{ed}(\psi J \rightarrow \psi' J') = e^2 \cdot \sum_{\lambda=2,4,6} \Omega_{\lambda} |\langle \psi J || U^{\lambda} || \psi' J' \rangle|^2 \tag{3}$$

$$S_{md}(\psi J \rightarrow \psi' J') = \frac{e^2 h^2}{16 \pi^2 m^2 c^2} \cdot |\langle \psi J || L + 2S || \psi' J' \rangle|^2 \tag{4}$$

where  $U^{\lambda}$  are the doubly-reduced matrix elements of rank  $\lambda$  and they are independent of the host matrix. The J-O intensity parameters,  $\Omega_{\lambda}$  ( $\lambda = 2, 4, 6$ ) have been evaluated from the method of least-square fitting of experimental (*f<sub>exp</sub>*) and calculated (*f<sub>cal</sub>*) oscillator strengths and they are summarized in Table 2. Reasonably small root mean square (r.m.s.) deviations show a good fit between *f<sub>exp</sub>* and *f<sub>cal</sub>* and the most excellent set of  $\Omega_{\lambda}$  parameters. The  $\Omega_{2,4,6}$  parameters are sensitive to the structural modifications in the host matrix and they describe the interaction of RE ions with the host network.

The  $\Omega_2$  parameter strongly depends on the host environment while the  $\Omega_4$  and  $\Omega_6$  parameters are less sensitive and do not vary much. In





**Table 2**  
Oscillator strengths and intensity parameters for BiBCeR glass and glass ceramics.

Absorption transition	Position $\lambda$ , (nm)	Oscillator strengths ( $\times 10^{-6}$ )					
		BiBCeR-G		BiBCeR-GC3		BiBCeR-GC4	
		$f_{exp}$	$f_{cal}$	$f_{exp}$	$f_{cal}$	$f_{exp}$	$f_{cal}$
$^4I_{15/2} \rightarrow ^4F_{7/2}$	488	1.328	1.371	1.518	1.552	2.042	2.016
$^4I_{15/2} \rightarrow ^2H_{11/2}$	521	5.361	5.363	6.392	6.395	8.409	8.411
$^4I_{15/2} \rightarrow ^4S_{3/2}$	545	0.425	0.352	0.284	0.384	0.544	0.494
$^4I_{15/2} \rightarrow ^4F_{9/2}$	651	1.342	1.328	1.600	1.603	2.091	2.118
$^4I_{15/2} \rightarrow ^4I_{9/2}$	798	0.193	0.196	0.280	0.254	0.413	0.342
$^4I_{15/2} \rightarrow ^4I_{11/2}$	976	0.487	0.448	0.538	0.496	0.683	0.641
$^4I_{15/2} \rightarrow ^4I_{13/2}$	1535	0.910	0.916	1.021	1.018	1.305	1.315
r.m.s. deviation ( $\times 10^{-6}$ )		$\pm 0.215$		$\pm 0.264$		$\pm 0.237$	
$\Omega_2 (\pm 0.005) \times 10^{-20} \text{ cm}^2$		2.757		3.226		4.188	
$\Omega_4 (\pm 0.002) \times 10^{-20} \text{ cm}^2$		0.709		0.925		1.233	
$\Omega_6 (\pm 0.004) \times 10^{-20} \text{ cm}^2$		0.722		0.782		0.995	

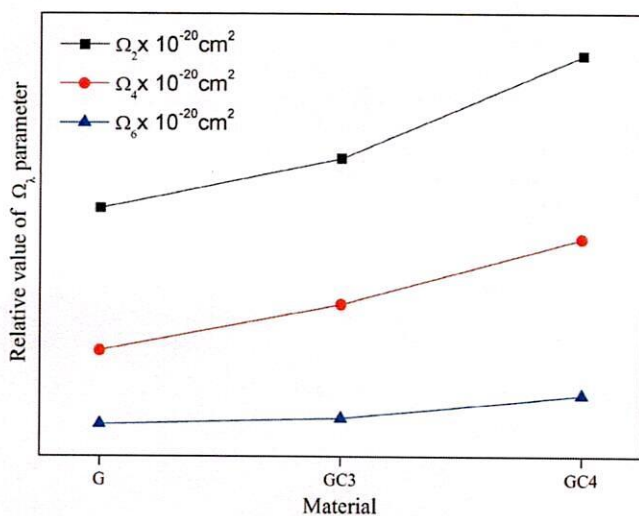


Fig. 7. Variation of  $\Omega_\lambda$  intensity parameters as a function of material.

**Table 3**  
J–O intensity parameters of  $\text{Er}^{3+}$  ions in different hosts.

Host material	J–O intensity parameters ( $\Omega_\lambda \times 10^{-20} \text{ cm}^2$ )			Trend
	$\Omega_2$	$\Omega_4$	$\Omega_6$	
BiBCeR-G [This work]	2.757	0.709	0.722	$\Omega_2 > \Omega_4 < \Omega_6$
BiBCeR-GC3 [This work]	3.226	0.925	0.782	$\Omega_2 > \Omega_4 > \Omega_6$
BiBCeR-GC4 [This work]	4.188	1.233	0.995	$\Omega_2 > \Omega_4 > \Omega_6$
GC640 [36]	3.64	0.92	0.66	$\Omega_2 > \Omega_4 > \Omega_6$
670GC [37]	2.70	1.14	1.27	$\Omega_2 > \Omega_4 < \Omega_6$
Fluoro-tellurite GC [38]	1.28	1.04	1.00	$\Omega_2 > \Omega_4 > \Omega_6$

this research work, the magnitudes of  $\Omega_\lambda$  parameters increase with the formation of nanocrystallites in the studied materials. The variation of  $\Omega_\lambda$  parameters versus the nature of material is illustrated in Fig. 7. Additionally, the  $\Omega_\lambda$  parameters show a quite different trend in BiBCeR-G and BiBCeR-GCs. They show  $\Omega_2 > \Omega_4 < \Omega_6$  trend in BiBCeR-G and  $\Omega_2 > \Omega_4 > \Omega_6$  trend in BiBCeR-GC3 and BiBCeR-GC4 samples. The trend of J–O intensity parameters evaluated for BiBCeR-GC4 materials are found to be similar to that of other glass ceramics [36–38]. The  $\Omega_\lambda$  parameters of  $\text{Er}^{3+}$  ions in different host materials are presented in

Table 3. The  $\Omega_2$  parameter gives the information regarding the asymmetric environment around the  $\text{Er}^{3+}$  ions in addition to the covalency of metal ion-ligand bond. Further, higher the magnitude of  $\Omega_2$  more will be the covalency of metal ion-ligand bond [39]. The  $\Omega_4$  and  $\Omega_6$  parameters together signify the rigidity of host matrix. In the present work, the increased values of  $\Omega_4$  and  $\Omega_6$  (see Fig. 7) reveal that the rigidity of studied materials increase with the formation of nanocrystallites against the glassy phase.

3.5. Optical band gap energy ( $E_{opt}$ )

For solid state laser hosts, the optical band-gap energy ( $E_{opt}$ ) is one of the key properties and it could be calculated using the following equation [40].

$$\alpha(\nu). h\nu = B (h\nu - E_{opt})^q \tag{5}$$

where  $\alpha(\nu)$  is the coefficient of absorption and B is a constant and it is free from the energy,  $\nu$ . The integer q is 2 for indirect-allowed transitions, 3 for indirect-forbidden transitions,  $1/2$  for direct-allowed transitions and  $1/3$  for direct-forbidden transitions. The values of  $E_{opt}$  are found to be 2.762, 2.731 and 2.702 ( $\pm 0.005$ ) eV for BiBCeR-G, BiBCeR-GC3 and BiBCeR-GC4, respectively by extrapolating the linear part of Tauc's plots shown in Fig. 8 to meet the  $h\nu$  axis at  $[\alpha(\nu). h\nu]^2 = 0$ . The observed values of  $E_{opt}$  decrease with the formation of nanocrystallites due to structural changes around the  $\text{Er}^{3+}$  ions. The evaluated value of  $E_{opt}$  for BiBCeR-GC4 is found close to phosphor-tellurite glass ceramic (R6h,  $E_{opt} = 2.75$  eV) [41].

3.6. NIR emission

The NIR emission spectra of BiBCeR-G, BiBCeR-GC3 and BiBCeR-GC4 obtained at 514.5 nm laser excitation are shown in Fig. 9. These spectra show a broad emission band with peak maximum at around 1.53  $\mu\text{m}$  due to  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition with sub-peaks corresponding to various Stark-levels. The intensity of emitted luminescence increases enormously with the formation of nanocrystallites. The emission mechanism of  $\text{Er}^{3+}$  ions at 514.5 nm excitation is also described in a partial energy level diagram shown in Fig. 9.

While designing  $\sim 1.53 \mu\text{m}$  optical fiber laser host with  $\text{Er}^{3+}$  ions, the knowledge on Stark energy levels is essential. In order to resolve the overlapping emission bands and to identify the individual bands, the deconvolution process has been applied assuming the Gaussian shapes of observed bands and the corresponding Gaussian amplitude peaks are labeled as A, B, C and D. The Gaussian amplitude peaks fitted to  $^4I_{13/2}$

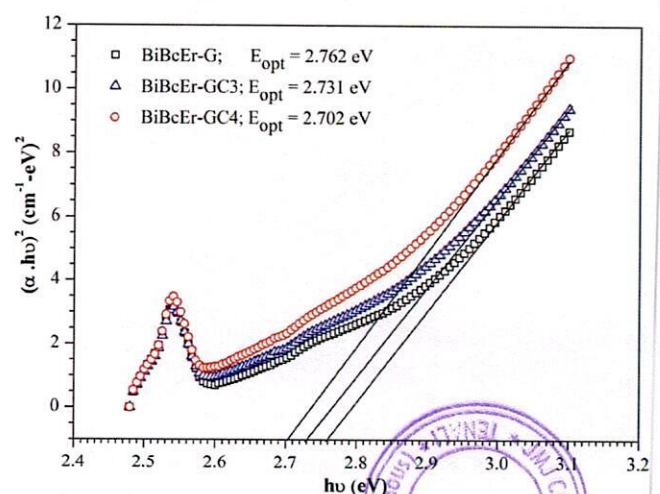


Fig. 8. Tauc's plots of  $\alpha(\nu).h\nu)^2$  against photon energy ( $h\nu$ ) for direct band gap measurements.

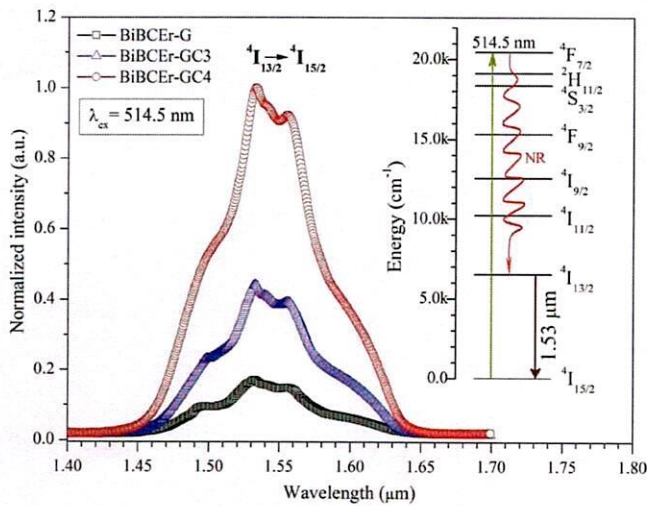


Fig. 9. NIR emission spectra in the 1.40–1.70 μm region and the emission mechanism of Er<sup>3+</sup> ions at λ<sub>exc</sub> = 514.5 nm.

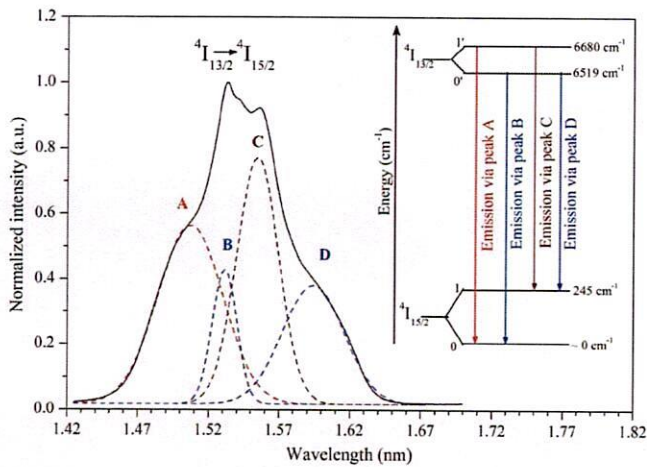


Fig. 10. The Gaussian amplitude peaks fitted to 1.53 μm (<sup>4</sup>I<sub>13/2</sub> → <sup>4</sup>I<sub>15/2</sub>) emission along with equivalent energy level model for BiBCEr-GC4.

<sup>2</sup> → <sup>4</sup>I<sub>15/2</sub> (~1.53 μm) emission along with equivalent energy level model showing the Stark-level energies and corresponding transitions for BiBCEr-GC4 sample are described in Fig. 10.

The <sup>4</sup>I<sub>13/2</sub> upper laser level is composed of two Stark-levels, namely 0' and 1'. The 1' Stark-level consists of a group of sub-levels in the energy range from 0.0 to 9.0 cm<sup>-1</sup>, however all these sub-levels can be treated as a single equivalent level. Similarly, the <sup>4</sup>I<sub>15/2</sub> lower laser level also composed of 0 and 1 Stark-levels which consists of group of sub-levels in the energy range from 0.0 to 15.0 cm<sup>-1</sup>. As observed from the NIR emission spectra, the 0, 1, 0' and 1' Stark levels are positioned at around 0, 245, 6519 and 6680 cm<sup>-1</sup>, respectively. The emission through sub-component peaks A, B, C and D has been ascribed to the (1' → 0), (0' → 0), (1' → 1) and (0' → 1) transitions, respectively. All these transition are described in Fig. 10. The Gaussian amplitude peaks A, B, C and D are positioned at around 1.49, 1.53, 1.55 and 1.59 μm, respectively and the corresponding full-width at half maximum values are found to be 0.054, 0.021, 0.036 and 0.050 μm which are comparable to those reported for TCW1 [42] and BBG8 [43] materials. These observations show that the sub-component peak A corresponding to 1' → 0 transition has wider FWHM and shorter wavelength whereas the sub-component peak D corresponding to 0' → 1 transition has wider FWHM and longer wavelength inducing higher inhomogeneous broadening to <sup>4</sup>I<sub>13/2</sub> →

<sup>4</sup>I<sub>15/2</sub> transition in BiBCEr-GC4 material.

In order to investigate the applicability of any optical fiber amplifier or laser, it is essential to analyze the overlap between the absorption and emission transitions which elaborates the population density of upper and lower laser levels and the gain cross-section [G(λ)] is a function of intensity as well as pump power of excitation radiation. The overlap regions of absorption and emission bands for BiBCEr-G and BiBCEr-GC-4 samples are described in Fig. 11. From these figures one can notice a large overlap region for both the samples indicating their utility for fiber amplifier as well as fiber laser applications.

### 3.7. Radiative parameters

The radiative parameters such as radiative transition probability (A<sub>R</sub>), radiative lifetime (τ<sub>R</sub>) and the radiative branching ratio (β<sub>R</sub>) has been used to evaluate the laser and/or gain parameters such as stimulated emission cross-section (σ<sub>E</sub>), band-width gain (ΔG) and optical gain per unit length or figure of merit of a fiber (G). Additionally, the effective bandwidth (Δλ<sub>eff</sub>) of radiative transition and the experimental lifetime (τ<sub>exp</sub>) of upper laser level are also crucial in designing an optical fiber laser. The radiative parameters of ψ<sub>J</sub> → ψ'<sub>J'</sub> transition have been evaluated applying the J–O theory [19,20].

$$A_R(\psi_J \rightarrow \psi'_{J'}) = \frac{64 \pi^4 \nu^3}{3 h (2J + 1)} \left\{ \frac{n(n^2 + 2)^2}{9} \cdot S_{ed} + n^3 \cdot S_{md} \right\} \quad (6)$$

$$\tau_R(\psi_J) = \frac{1}{\sum A_R(\psi_J \rightarrow \psi'_{J'})} \quad (7)$$

$$\beta_R(\psi_J \rightarrow \psi'_{J'}) = \frac{A_R(\psi_J \rightarrow \psi'_{J'})}{\sum A_R(\psi_J \rightarrow \psi'_{J'})} \quad (8)$$

where ν represents the energy corresponding to upper (ψ<sub>J</sub>) laser level. If the branching ratio is greater than 0.50, then the corresponding transition emits intense and efficient laser through that transition. The experimental values of branching ratios have been obtained using the integrated area of observed emission transitions. For the studied glass and glass ceramic samples, the experimental branching ratio (β<sub>exp</sub>) is found to be 1.0. The effective bandwidth parameters (Δλ<sub>eff</sub>) have been useful to evaluate σ<sub>E</sub> and ΔG. The values of Δλ<sub>eff</sub> can be obtained using the following equation.

$$\Delta\lambda_{eff} = \frac{\int I(\lambda) \cdot d\lambda}{I_p} \quad (9)$$

where I<sub>p</sub> is the luminescence intensity corresponding to peak maximum (λ<sub>p</sub>). The radiative parameters evaluated for BiBCEr-G and BiBCEr-GC-4 samples are summarized in Table 4. The observed radiative parameters of BiBCEr-GC-4 are close to those reported for 670GC [37], Fluoro-tellurite GC [38] and R6h [41] glass ceramics.

### 3.8. Emission cross-sections

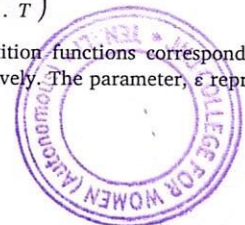
According to J–O theory [19,20], the stimulated emission cross-section (σ<sub>E</sub>) of ψ<sub>J</sub> → ψ'<sub>J'</sub> transition is given as

$$\sigma_E(\psi_J \rightarrow \psi'_{J'}) = \frac{\lambda_p^4}{8 \pi c n^2 \Delta\lambda_{eff}} \cdot A_R(\psi_J \rightarrow \psi'_{J'}) \quad (10)$$

where λ<sub>p</sub> represents wavelength corresponding to peak maximum and c represents the speed of light. The emission cross-sections can also be evaluated using the Mc Cumber's theory [21]. According to Mc Cumber, the stimulated emission cross-section (σ<sub>E</sub><sup>M</sup>) of ψ<sub>J</sub> → ψ'<sub>J'</sub> transition can be evaluated using the following equation.

$$\sigma_E^M(\psi_J \rightarrow \psi'_{J'}) = \sigma_A \left( \frac{Z_L}{Z_U} \right) \exp \left( \frac{\epsilon - h\nu}{K_B \cdot T} \right) \quad (11)$$

where Z<sub>U</sub> and Z<sub>L</sub> represent the partition functions corresponding to upper and lower laser levels, respectively. The parameter, ε represents



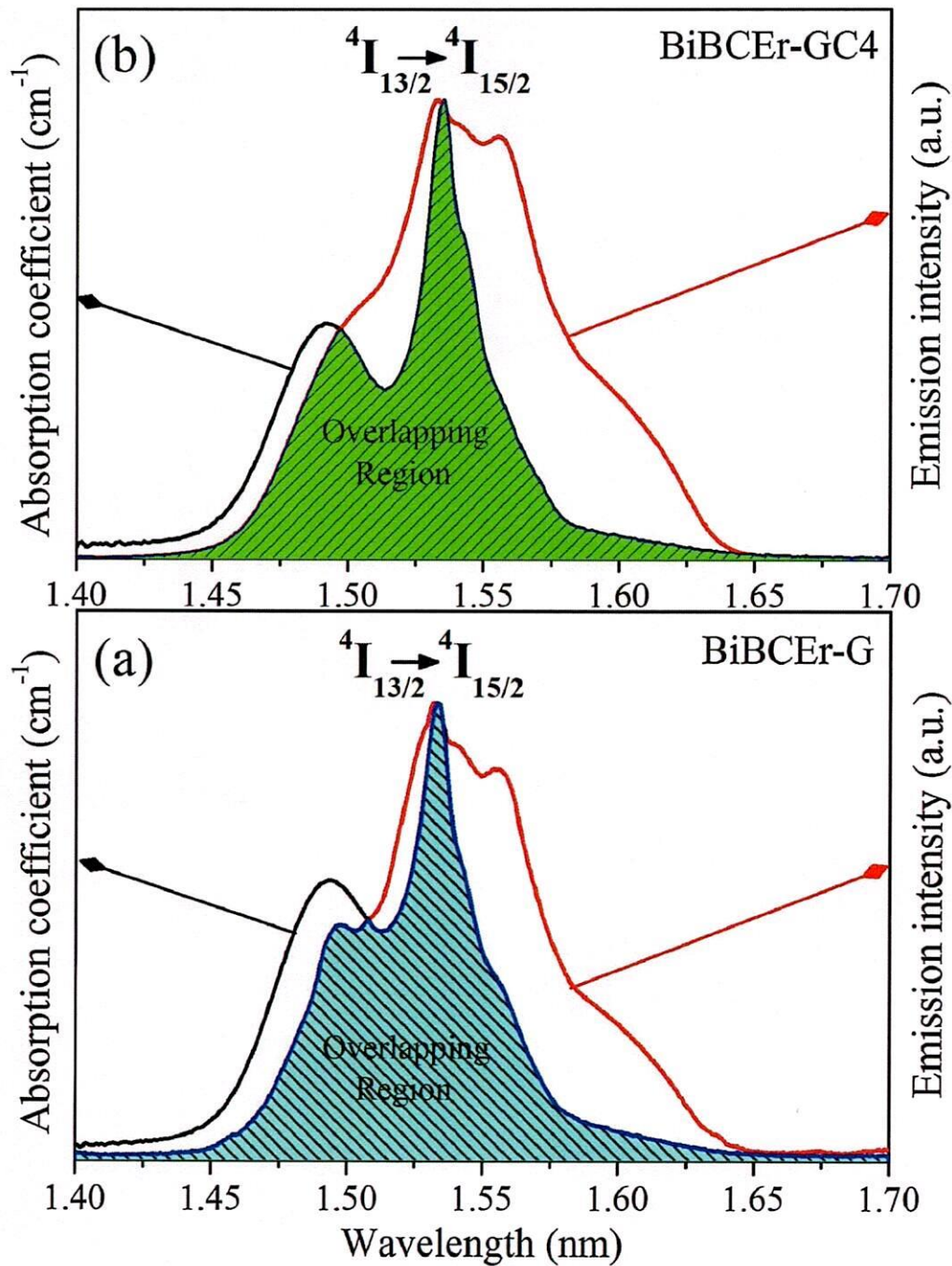


Fig. 11. Absorption and emission spectral overlap for BiBCEr-G and BiBCEr-GC4.

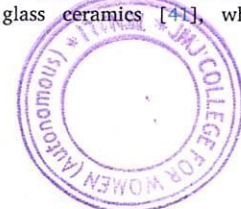
the net-free energy necessary to pump the  $\text{Er}^{3+}$  ions at  ${}^4\text{I}_{15/2}$  lower laser level to  ${}^4\text{I}_{13/2}$  upper laser level at absolute temperature,  $T$  and it can be obtained using the following equation [44].

$$\frac{N_1}{N_2} = \exp\left(\frac{\epsilon}{K_B \cdot T}\right) \tag{12}$$

where  $N_1$  and  $N_2$  are the population densities of  ${}^4\text{I}_{15/2}$  and  ${}^4\text{I}_{13/2}$  levels, respectively and  $K_B$  is the Boltzmann constant. The parameter,  $\sigma_A$  represents the absorption cross-section of  $\text{Er}^{3+}$ :  ${}^4\text{I}_{15/2} \rightarrow {}^4\text{I}_{13/2}$  transition and it can be obtained using the following equation [44].

$$\sigma_A = \left(\frac{2.303}{N \cdot t}\right) \cdot \log\left(\frac{I_0}{I}\right) \tag{13}$$

where  $N$  is the  $\text{Er}^{3+}$  ions concentration in ions/ $\text{cm}^3$ ,  $t$  is the optical path length of the sample and  $\log(I_0/I)$  is the molar absorptivity. Usually, the ratio of upper and lower partition functions ( $Z_1/Z_2$ ) has been considered as unity. The absorption and stimulated emission cross-sections as a function of wavelength for BiBCEr-G and BiBCEr-GC-4 are illustrated in Fig. 12. As seen Fig. 12, one can notice that the maximum wavelength ( $\lambda_p = 1.53 \mu\text{m}$ ) corresponding to absorption and emission cross-sections remains the same. In case of BiBCEr-GC4 sample, the value of emission cross-section ( $\sigma_E^M$ ) obtained from the Mc Cumber's theory ( $2.646 \times 10^{-21} \text{cm}^2$ ) is very close to that obtained from the J-O theory ( $2.727 \times 10^{-21} \text{cm}^2$ ). The absorption cross-section values are comparable to phospho-tellurite glass ceramics [41], while the



**Table 4**

Radiative parameters such as peak maximum wavelength ( $\lambda_p$ ), effective bandwidth ( $\Delta\lambda_{eff}$ ), radiative transition probability ( $A_R$ ), radiative branching ration ( $\beta_R$ ), radiative lifetime ( $\tau_R$ ), experimental lifetime ( $\tau_{exp}$ ) and quantum efficiency ( $\eta_{QE}$ ) of  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition of  $Er^{3+}$  ions for different hosts.

Radiative parameter	BiBCEr-G [This work]	BiBCEr-GC4 [This work]	670GC [37]	Fluoro-tellurite GC [38]	R6h [41]
$\lambda_p, \mu m$	1.533	1.533	1.546	1.540	1.532
$\Delta\lambda_{eff}, nm$	85.48	92.48	85.0	64.0	71.43
$A_R, s^{-1}$	100.43	120.98	121.8	–	147.72
$\beta_R$	1.00	1.00	1.00	1.00	1.00
$\tau_R, ms$	9.96	8.26	8.21	3.73	6.82
$\tau_{exp}, ms$	7.26	7.44	8.03	3.10	6.51
$\eta$ (%)	72.9	90.0	97.8	83.0	95.0

stimulated emission cross-section are found in the range of LBTAFeR10 [34] and PTBER10 [45]. The values of emission and absorption cross-sections are listed in Table 5.

**3.9. Gain parameters**

The optical gain cross-section ( $G(\lambda)$ ) is one of the significant laser characteristic parameters and it can be related to  $\sigma_E$  and  $\sigma_A$  as well as the population inversion ( $P$ ) between the upper and lower laser levels. The optical gain cross-section of a laser host material has been evaluated according to the relation [46].

$$G(\lambda) = N \cdot [P \cdot \sigma_E(\lambda) - (1 - P) \cdot \sigma_A(\lambda)] \tag{14}$$

The wavelength dependent gain cross-sections of  $Er^{3+}$ :  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition for different values of  $P = 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9$  and  $1.0$  for BiBCEr-G and BiBCEr-GC-4 samples are illustrated in Fig. 13. In the present investigation, the increase in population inversion not only leads to improve the gain cross-section but also cause zero shifts in the position of gain cross-sections. The higher values of  $P$  results both broader bandwidth and higher gain coefficient [46].

As seen Fig. 13 one can notice that when the population inversion,

**Table 5**

Comparison of stimulated emission cross-sections ( $\times 10^{-21} cm^2$ ) and absorption cross-sections ( $\sigma_A \times 10^{-21} cm^2$ ) of  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition of  $Er^{3+}$  ions for different hosts.

Host material	Emission cross-sections		$\sigma_A$
	$\sigma_E$	$\sigma_E^M$	
BiBCEr-G [This work]	2.502	2.434	2.407
BiBCEr-GC3 [This work]	2.598	2.255	2.330
BiBCEr-GC4 [This work]	2.727	2.646	2.675
R6h [41]	4.49	–	2.84
Phospho-tellurite [41]	5.52	–	3.64
LBTAFeR10 [34]	4.45	3.79	–
PTBER10 [45]	5.37	5.72	–

$\sigma_E$  : Stimulated emission cross-sections from Judd-Ofelt' theory.

$\sigma_E^M$ : Stimulated emission cross-sections from Mc Cumber's theory.

$P \geq 0.7$  then the gain cross-section becomes positive. This means that for  $P \geq 0.7$ , the BiBCEr-G and BiBCEr-GC-4 samples exhibit flat gain cross-section in the spectral region from 1.45 to 1.63  $\mu m$ , which covers S-band, C-band, and L-band regions of telecommunication windows. The BiBCEr-G and BiBCEr-GC-4 samples show a net gain cross-section of  $1.957 cm^{-1}$  and  $2.169 cm^{-1}$ , respectively for total population inversion ( $P = 1.0$ ). Compared to BiBCEr-G, the BiBCEr-GC-4 exhibits relatively higher value of  $G(\lambda)$  and thus it is more attractive than the other interesting hosts reported in the literature [41,47]. Table 6 presents the gain cross-sections of  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transition of  $Er^{3+}$  ions for different population inversions in different hosts. Thus, the BiBCEr-GC-4 could be suitable for more channels in the wavelength division multiplex (WDM) networks.

The band-width gain [ $\Delta G = (\sigma_E \times \Delta\lambda_{eff})$ ] and optical gain per unit length [ $G = (\sigma_E \times \tau_{exp})$ ] are of more significant to design a fiber laser and they can be evaluated from the effective bandwidth ( $\Delta\lambda_{eff}$ ), the stimulated emission cross-section ( $\sigma_E$ ) and the experimental lifetime ( $\tau_{exp}$ ) of upper laser level. For BiBCEr-GC-4, the values of  $\Delta G$  and  $G$  are found to be  $2.522 \times 10^{-26} cm^3$  and  $2.029 \times 10^{-23} cm^2s$ , respectively.

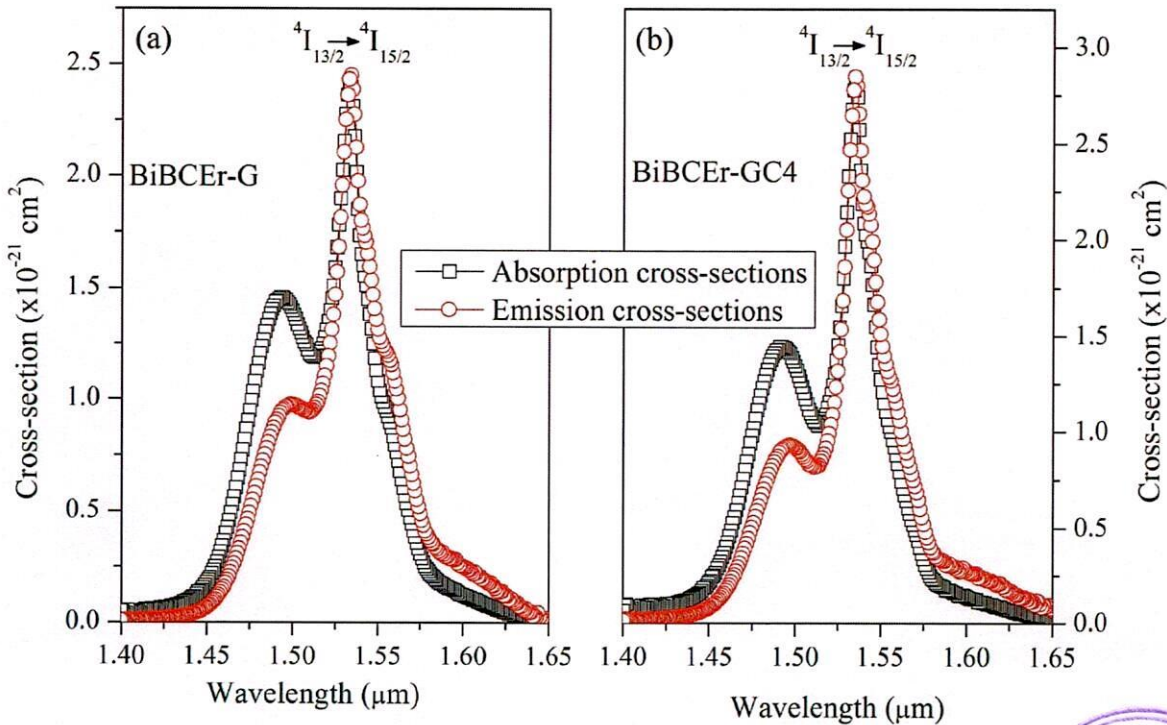


Fig. 12. Absorption and emission cross-sections of  $^4I_{13/2} \rightarrow ^4I_{15/2}$  transitions for BiBCEr-G (a) and BiBCEr-GC4 (b).



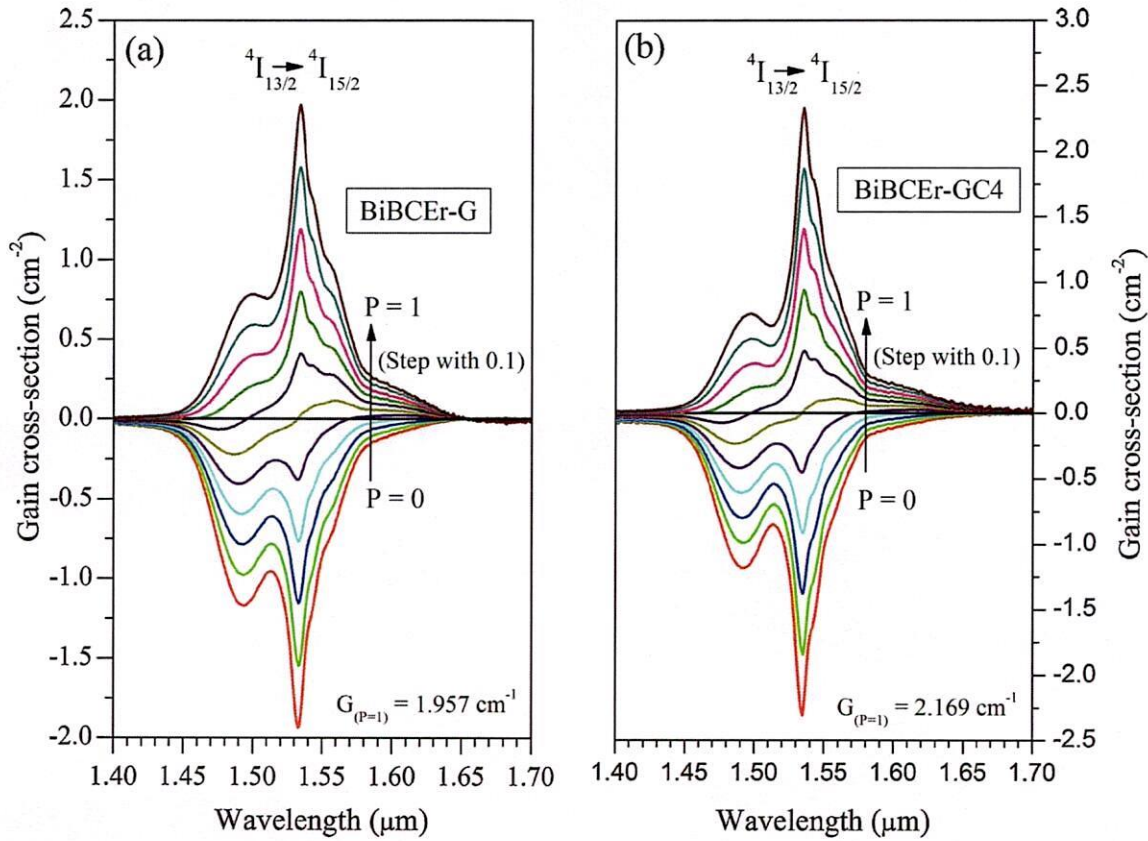


Fig. 13. Gain cross-section spectra of  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition as a function of population inversion for BiBCer-G (a) and BiBCer-GC4 (b).

Table 6

Gain cross-sections of  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition of  $Er^{3+}$  ions for different population inversions in different hosts.

Host material	Gain cross-sections $G(\lambda)$ (in $cm^{-1}$ )			
	P = 0.7	P = 0.8	P = 0.9	P = 1.0
BiBCer-G [This work]	0.789	1.178	1.568	1.957
BiBCer-GC4 [This work]	0.861	1.297	1.733	2.169
Phospho-tellurite [41]	-	-	-	2.33
R6h [41]	-	-	-	1.88
SBNCer05 [47]	-	-	-	1.008

Similarly for BiBCer-G, they are found to be  $2.502 \times 10^{-26} cm^3$  and  $1.817 \times 10^{-23} cm^2 s$ . The band-width gain value of BiBCer-GC-4 is found close to R6h glass ceramic [41], TCZNBer1.0 glass [48] and Er:NAPT glass [49]. The optical gain per unit length of BiBCer-GC-4 is comparable to Er:NAPT glass and found lower than that of BiBCer-G and TCZNBer1.0 glass. The peak emission wavelength, effective band-

width, stimulated emission cross-section, band-width gain and optical gain per unit length of  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition of  $Er^{3+}$  ions for different hosts are summarized in Table 7.

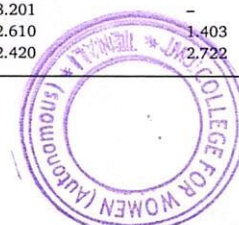
3.10. Dynamics of excited energy level

To understand the dynamics involved in the excited energy level of  $Er^{3+}$  ions and to obtain the effect of partial crystallization on 1.53  $\mu m$  emission corresponding to the  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition, the photoluminescence decay of  ${}^4I_{13/2}$  excited level has been studied by exciting at 980 nm laser radiation. The decay profiles of  $Er^{3+} : {}^4I_{13/2}$  excited level monitoring the emission at 1.53  $\mu m$  in BiBCer-G and BiBCer-GC4 are illustrated in Fig. 14. For BiBCer-G, the decay profile follows a single exponential function while for BiBCer-GC4, it shows non-exponential behaviour. The non-exponentiality noticed in the excited state dynamics has been assigned to the one of the interaction mechanisms such as exchange, dipole-dipole (d-d), dipole-quadrupole (d-q) and quadrupole-quadrupole (q-q) interactions. Since  $Bi_3B_5O_{12}$  and  $CaF_2$  crystallized into nanoscale, the exchange interaction

Table 7

Peak emission wavelength ( $\lambda_p$ ,  $\mu m$ ), effective band-width ( $\Delta\lambda_{eff}$ , nm), stimulated emission cross-section ( $\sigma_E \times 10^{-21} cm^2$ ), band-width gain ( $\Delta G \times 10^{-26} cm^3$ ) and optical gain per unit length ( $G \times 10^{-23} cm^2 s$ ) of  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition of  $Er^{3+}$  ions for different hosts.

Host material	Gain parameters of $Er^{3+} : {}^4I_{13/2} \rightarrow {}^4I_{15/2}$					Reference
	$\lambda_p$	$\Delta\lambda_{eff}$	$\sigma_E$	$\Delta G$	G	
BiBCer-GC4	1.533	92.48	2.727	2.522	2.029	[This work]
BiBCer-G	1.533	85.48	2.502	2.139	1.817	[This work]
R6h	1.532	71.43	4.490	2.649	-	[41]
Phospho-tellurite	1.532	70.47	5.520	3.201	-	[41]
TCZNBer1.0	-	80.82	3.22	2.610	1.403	[48]
Er:NAPT	-	55.0	4.37	2.420	2.722	[49]



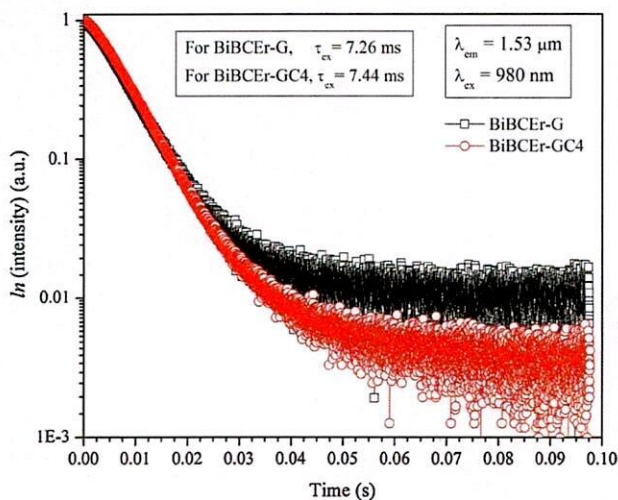


Fig. 14. Logarithmic plots of decay profiles of  ${}^4I_{13/2}$  emission level for BiBCEr-G (a) and BiBCEr-GC4 (b).

mechanism among the excited  $Er^{3+}$  ions predominates the other mechanisms resulting non-exponential behaviour.

The experimental decay time ( $\tau_{exp}$ ) of  $Er^{3+}$ :  ${}^4I_{13/2}$  excited level in BiBCEr-G sample is achieved by fitting to single exponential function:  $I_t = I_0 \cdot e^{-t/\tau}$ , where  $I_0$  is the fluorescence intensity at  $t = 0$  s and  $\tau$  is the lifetime of excited energy level and by taking the first e-folding time of the initial intensity of decay curve. The decay time of BiBCEr-GC-4 sample has been obtained by fitting the decay curve to double exponential function,  $I_t = A_1 \cdot e^{-t/\tau_1} + A_2 \cdot e^{-t/\tau_2}$ , where  $\tau_1$  and  $\tau_2$  be the decay times for slow and fast decay components from two different sites. The average decay time,  $\langle\tau\rangle$  can be obtained using the following equation.

$$\langle\tau\rangle = \frac{A_1\tau_1^2 + A_2\tau_2^2}{A_1\tau_1 + A_2\tau_2} \quad (15)$$

The values of  $\tau_{exp}$  are found to be 7.26 and 7.44 ms for BiBCEr-G and BiBCEr-GC4, respectively. These values reveal that the decay time of  $Er^{3+}$ :  ${}^4I_{13/2}$  excited level has been enhanced by a small amount when BiBCEr-G transformed into BiBCEr-GC4 which contains both  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystallites. As the ionic radius of  $Er^{3+}$  ( $\sim 0.103$  nm) is almost close to that of  $Bi^{3+}$  (0.117 nm) and  $Ca^{2+}$  (0.114 nm), one can predict an equal probability of occupying the sites of  $Bi^{3+}$  in  $Bi_3B_5O_{12}$  crystallites and  $Ca^{2+}$  in  $CaF_2$  crystallites. Since the  $Er^{3+}$  ions are trivalent, the probability of occupation of  $Bi^{3+}$  ion sites is much more compared to the  $Ca^{2+}$  ion sites. The XRD, SEM and NIR emission studies confirm the formation of  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystallites. From the SEM investigations it is clear that the percentage of formation of  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystallites is relatively small against the ( $Bi_2O_3$ - $B_2O_3$ ) glassy phase. The XRD analysis reveals that the sizes of  $Bi_3B_5O_{12}$  and  $CaF_2$  crystallites are of the order of  $\sim 40$  nm and  $\sim 37$  nm, respectively. It is well known that a glass-ceramic is a combination of glassy and crystalline phases. Therefore, the RE active ions can occupy the glassy as well as crystalline sites.

The studied observations make known that the majority of  $Er^{3+}$  ions have been accommodated in  $Bi_2O_3$ - $B_2O_3$  glassy phase and considerably less number of  $Er^{3+}$  ions occupies the  $Bi^{3+}$  ion sites. In the present investigation it can be predicted that the probability of occupation of  $Er^{3+}$  ions in  $Ca^{2+}$  sites is almost negligible. For the studied  $ErF_3$  concentration (1.0 mol%) in BiBCEr-G sample, the decay profile of  $Er^{3+}$ :  ${}^4I_{13/2}$  emission level exhibits single exponential nature with fitting constant,  $A \approx 1.073$ . In this case, all the  $Er^{3+}$  ions are well located in the glassy phase only. In case of BiBCEr-GC4 sample, the decay profile show double exponential behaviour with fitting constants,  $A_1 \approx 1.079$  and  $A_2 \approx 0.020$ . It could be assumed that the fitting constant  $A_1$

belongs to the  $Er^{3+}$  ions in glassy phase and the constant  $A_2$  belongs to the  $Er^{3+}$  ions in  $Bi^{3+}$  sites. Thus, the decay time of  $Er^{3+}$  ions does not vary much when BiBCEr-G transformed into BiBCEr-GC4 by the application of heat treatment.

The lasing and/or amplification performance of a material depends on experimental decay time as well as the fluorescence quantum efficiency, which is the ratio of experimental decay time to radiative decay time ( $\eta = \tau_{ex}/\tau_R$ ). For BiBCEr-G and BiBCEr-GC4 samples, the fluorescence quantum efficiencies are obtained as 72.9% and 90.0%, respectively. The value of  $\eta$  obtained for BiBCEr-GC4 sample, is found comparable to other glass ceramics reported in literature [37,38,41]. A comparison of quantum efficiencies in different hosts is presented in Table 4. Further, the magnitudes of experimental decay time and quantum efficiency of  $Er^{3+}$ :  ${}^4I_{13/2}$  excited level are directly related to the optical amplification performance which is the measure of aptness of the synthesized materials for fiber laser applications.

#### 4. Conclusions

The  $Er^{3+}$  ions doped  $Bi_2O_3$ - $B_2O_3$  transparent glass ceramics containing  $CaF_2$  have been prepared successfully by thermal treatment. XRD studies have revealed the presence of  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystallites. Applying the Debye-Scherrer's equation, the average size of  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystals is found to be 40 nm and 37 nm. SEM results of BiBCEr-GC4 illustrate the homogeneous distribution of  $Bi_3B_5O_{12}$  and  $CaF_2$  nanocrystals surrounded by the amorphous phase. EDX measurements confirm the presence of boron, bismuth, calcium, oxygen and fluorine elements. FTIR studies reveal that the BiBCEr-GC4 has phonon energy of the order of  $1334.67$   $cm^{-1}$ . The J-O intensity parameters have been used to evaluate various radiative and laser characteristic parameters. The optical band gap investigations show that the direct band gap energies of BiBCEr-G, BiBCEr-GC3 and BiBCEr-GC4 are found to be 2.762, 2.731 and 2.702 eV, respectively. The NIR emission analysis of BiBCEr-G, BiBCEr-GC3 and BiBCEr-GC4 has been done by exciting at 514.5 nm laser. The 1.53  $\mu m$  emission through  $Er^{3+}$ :  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition has been improved significantly after the formation of  $Bi_3B_5O_{12}$  and  $CaF_2$  crystallites in the host matrix. The stimulated emission cross-section in the 1.53  $\mu m$  region determined from the J-O theory ( $2.727 \times 10^{-21}$   $cm^2$ ) is found close to that obtained from the Mc Cumber's theory ( $2.646 \times 10^{-21}$   $cm^2$ ). A maximum gain cross-section of  $2.169$   $cm^{-1}$  has been obtained for BiBCEr-GC4 for population inversion,  $P = 1.0$ . A considerable enhancement in quantum efficiency is noticed after formation of crystalline phase. The bandwidth gain ( $\Delta G$ ) and the optical gain per unit length ( $G$ ) of  $Er^{3+}$ :  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition has been determined. The effect of partial crystallization on 1.53  $\mu m$  emission through  $Er^{3+}$ :  ${}^4I_{13/2} \rightarrow {}^4I_{15/2}$  transition has been investigated through excited state dynamics at 980 nm Laser excitation. For BiBCEr-GC4, the fluorescence quantum efficiency is obtained as 90.0%. The present investigation suggests that the BiBCEr-GC4 is more favourable to design a new class of 1.53  $\mu m$  optical fiber lasers for diverse applications.

#### CRedit authorship contribution statement

**B.C. Jamalajah:** Conceptualization, Methodology, Software, Writing - original draft, Investigation, Supervision, Visualization, Formal analysis, Validation, Writing - review & editing, Project administration, Funding acquisition. **G. Viswanadha:** Methodology, Software, Writing - original draft, Investigation, Data curation.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

