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ENGINEERING INSTITUTES AND THEIR FINANCIAL BOTTLENECK IN THE PERSPECTIVE OF NATIONAL EDUCATIONAL POLICY 2020

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Abstract:
The educational scenario in Indian context needs to be analysed with reference to a huge volume of unemployable graduates, poor industrial growth rate and a variety of problems woven in the intricate fabrics of socio economics. It is observed that the problem of quality education is complex. It has social, economic, political and policy related aspects that are deeply inter - woven. The present paper vis – a –vis examines the complexities of these aspects and highlights that the human resource has been an factor that needs more consideration. This ignorance or lack of consideration to the factor of human resources has been the big bottle neck in the educational sector owing to which the sector is not meeting the expectations of modern India. The new education policy has emerged as a ray of hope in dark and the education sector looks towards it with great aspiration. India is at the verge of transformation, from developing nation to the developed nation. Education, particularly engineering education is going to be the back bone of this transformation.

Keyword: New Educational Policy, Engineering education, financial constraint.

1. Basic elements of Economics in Engineering Institutes:-

Generation of financial resources is crucial for any self-finance engineering educational institute for development. It is mainly through student fees. This fee is decided by the state level fee committee which considers expenditure incurred in previous financial year and intake capacity of the engineering institutes. But the disgusting fact is that there are many engineering colleges are unable to get filled all available seats. In turns, it results in reduction in fees in successive academic years. Thus there is an effective reduction in total collection of fee receipt. It leads to financial crunch in the system and degrades the quality of education in the engineering institutes.

There is a delay in scholarship amount disbursement from the administration leads to increased financial crunch in engineering institutes. Regular expenses, including salary etc are pending in many engineering institutes. It degrades the overall performance of these engineering colleges and adversely affects the market repo of the engineering institutes. Ultimate effect is less admissions and further degradation in the overall performance of the institutes.

i. Demand of Technocrats and Societal Attitudes :-

There is an emerging shortage of skilled manpower in the country in all sectors. Despite advancement in technology, the behaviour of parents & students is traditional in nature. The way students opt courses of their study is completely non-scientific. They do not consider the interest,

liking, even eternal skills and career paths of themselves. In course or college selection people are blindly following trends rather than interest, which leads them in ambiguous information and non-reasonable career paths that are unsuitable to them.

Demand of cutting edge technology is increasing day by day. Advanced and emerging technologies such as Artificial Intelligence, machine learning, block chain technology, virtual reality, and augmented reality are the aspect which will have vital role in Industry 4.0.But institutes are having shortage in trained teachers and resources, even in institute of repute, for such advanced technology in our country. Further there is a disruptive gap of income and awareness in the rural and urban sector in the country. Hence the resulting demand of engineering colleges is very fluctuating. Where the parents have been spending a good deal of amount on the education and have readiness to pay in urban areas as opposed to rural areas. In urban areas both the income and substitution effects are strong and the quality demanded responds strongly to fee increases. The situation is reversed in rural sections.

ii. Investment in Engineering Institutes :-

The time has come when it needs to critically examine the financingofhighereducationby government. Because the basic needs like skill development is not being full filled by the present system. Targets that were set about half acenturyago are still un fulfilled.It is being realized that higher education could not be sustained solely by the government; rather it can expandonlybythe support of privatisation. Onlythoseorganizations which mobilize the investmentin highereducation, at pace with time demand,are foundtobe able to achieveglobal educational standards. Further, the numberofeducated unemployedis hyping up yearafter year. It is a criminal wastage ofinvestmentmadeby thesociety and state inhigher education. Inthis overallbackground, a fewmajor dimensions ofinvestmentinhighereducation in India to be critically investigated.

There is a huge investment in in frastructuresector in engineering institutes. But proportionately very less in human resource development such as faculty development, student trainings, internationalization, technology used in teaching – learning, etc. The combined effect of all this have hampered the quality of education in the campuses. The new National Education Policy (NEP) takes cognition of this scenario and suggests certain measures to correct in these regards.

iii. Uncertainty in Education Sector:-

Life is full of uncertainties. e. g. One has his/her stake in engineering institutes. May be as a governing body member, teacher or staff member. What is the bottleneck would face by him/her? The major risks isindustrial slowdown in the country. Associate with this is the risk of unemployment which in turn will reduce admissions in engineering colleges. In addition to this there are uncertainties of inflation rates and taxes in uncharted terrain. Further you are un-predictive about the performance of agricultural sector due to uncertain climate conditions. It affects income of rural house hold and decides their spending capacity on education.

The economic issues in engineering institutes portray complexities that are not possible to forecast at early stage. Many of these aspects involve risk, uncertainty and incompleteness ofinformation. Our engineering institutes must also note the uncertainties of performance of industry and service sector, unemployment status, inflation, taxes, financial condition of society, educational loan rates, etc. Similarly parents must compete with uncertainty about wages available in future, employment

opportunities/avenues available for their wardin future and of course about the return on their investments in education. The same fear is felt by stakeholders also in investment in sector of engineering institutes. Hence the ground level realities of engineering institutes is not completely realized without a comprehensive study of the economical, societal and national issues involved in decision making under uncertainty and risk involved.

iv. The Challenge of Quality Education in Engineering Institutes:-

It should be well understood that engineering institutes face great hurdles in integrating the four elements of progress – human resource, capital, investment and Entrepreneurship &Innovation. Further, these difficulties reinforce each other with synergetic effects in a vicious cycle of low quality education. This is shown by figure 1.

Figure1:

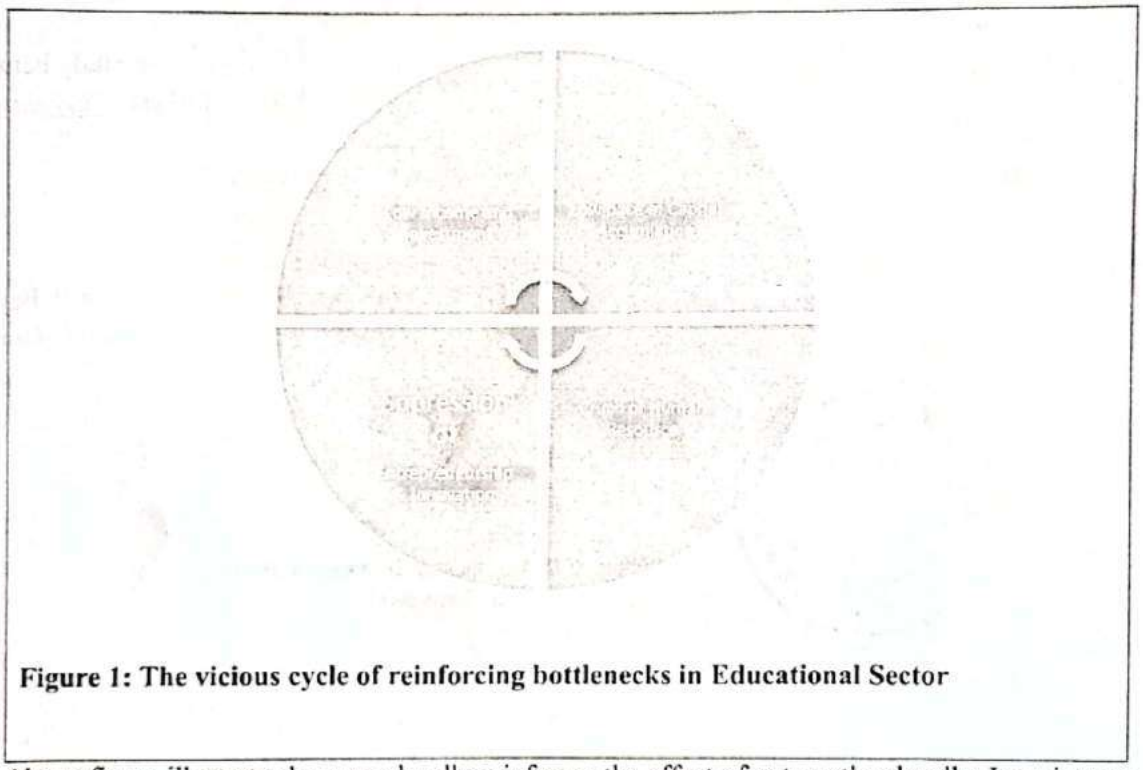

Figure 1: The vicious cycle of reinforcing bottlenecks in Educational Sector

Above figure illustrates how one hurdle reinforces the effect of yet another hurdle. Low income and low investment causes low pace of capital gain; it causes distraction of human resources and consequently retards the entrepreneurship & innovations i.e. the outcome of professional education as a quality remark. In effect is leads to low quality education, technological skills; these in turn prevent the adoption of new and improved technologies and lead to rapid depletion of quality of educational, which swipes away its improvements.

Achieving excellence in engineering education difficult because of above – mentioned these challenges. They are commonly faced occurred in allengineering institutes.

Conclusions:

World's ancient most universities are found in India. Ancient India had a novel educational system and the country had been fetching scholars and students from across the world. Yet the present educational system in India is unable to inculcate employability or entrepreneurship in students. It does not inspire creativity in students. The present paper has identified that the principal cause of it is the inadequacy of financial resources being offered to educational institutes. In the entire cycle of education the teacher is the least cared factor. It should be hoped that the new educational policy will give due emphasis to the human resource and will radically transform the scenario. This will help in preparing the youth of future who in turn will build the future of country. The country all prepared to re-acquire its status of '*Jagat Guru*'(Master of the World).

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Stress Management at Makra Group of Industries, Jalgaon: a case study

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Abstract: Stress management is an approach used by the organization for higher productivity, quality output and optimum performance of workers. The present work is a case study for Makra Group of industries at Jalgaon. The stress levels of workers at different levels has been assessed through observation, discussions and questionnaire. Regressive analysis of the responses of workers has been done. The stress level has been assessed. Stress management strategy has been proposed to improve the scenario of stress management in Makra group of Industries. Suggestions have been given to remove the bottle necks in stress management plan.

Key words: Makra group of industries, stress level assessment, stress management plan.

1. Introduction:

Stress is a mental state of tension and worry owing to problems in life, work, etc. It results into strong feelings of worry or anxiety, physical force or pressure [1]. Stress reduces the work efficiency and reduces output. Stress even affects the health of worker and makes it physically and mentally unfit. The problem gradually percolates to the worker's family. Hence, every organization needs to the sources, causes and types of stresses and the measures to eliminate them.It is important to know that not all situations that are referred "stressful" are negative also [2]. In fact in limited extent, stress has positive effect. It is a motivational force. It is the stress beyond limits which is harmful. Truly speaking, stress management does not refer to avoiding or escaping stress rather it is control the reaction of one's mind, Stress management is the skill of mind – body adjustment, which has to be developed [3, 4].

The present work is a case study pertaining to Makra group of Industries, a medium size industry in Jalgaon city. It is involved in variety of businesses. The present paper has assessed the stress level of workers of Makra, the strategies used by the organization to curb the stresses and their effectiveness. It is hoped that this is going to be of practical use to organization dealing with work force issues.

2. The Makra group of Industries:

Mkara is the brand name of group of industries established by Late Yusuf Ali Adamji, Makra group in 1908 at Jalgaon [5]. Today Mr ShabbitbahiMakra and his son are managing directors. They started with manufacturing nails. Today it is the largest nail manufacturing company in Jalgaon district with an status of being only manufacturers of bullock shoe nails

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in western India. Gradually they entered into Trading of Nut bolt, Welding Rod, Fireworks, & Hardware items like Barbed Wire & GI Wire. Makras is the only chain link manufacturing unit making wire mesh of more than 10 inch width, and barbed wire of any customized length, wire gauge and weight in Jalgaon district. Today Makra is a name referring to Innovative thinking, personal responsibility, latest technology use, uncompromising qualities, prompt services and reliability. The company has good hold on export market in Malaysia, Singapore and China.

The company provides accommodation space in factory for out state labor. It has received award for this welfare scheme. It also provides assistance to employees for their children'seducation.

3. Methodology

The primary source of data is used in the present work collected directly. The various units of Makra group of Industries has 180 employees including top level to lowermost levels. We have done regressive literature survey and identified parameters to assess the employee's stress level and management's strategy to control the stress level or eliminate the same. The closed ended questionnaire has been prepared and physically circulated in the employees and their responses have been analyzed. Meaning that the respondents are given opportunity to select from available options not to write at their own [6]. The responses have been depicted on graphs and discussed to draw interpretations. The employees are given questionnaire in local language (Marathi) and illiterate employees are given assistance.

Apart from the primary data, information is collected from company's internal records, audit reports and web site etc and used as secondary data [7].

The questions are given along with results.

4. Results and discussions:

The questions and responses are given below one by one:

i) Since how long have you been working in Makra group?

a) Less than 1 yearb) 1-5 yearsc) 5-10 yeard) More than 10 year

Response

	Less than 1year	1-5 year	5-10 year	More than 10 years	Total
No. of employees	45	36	54	45	180
Percentage	25	20	30	25	100

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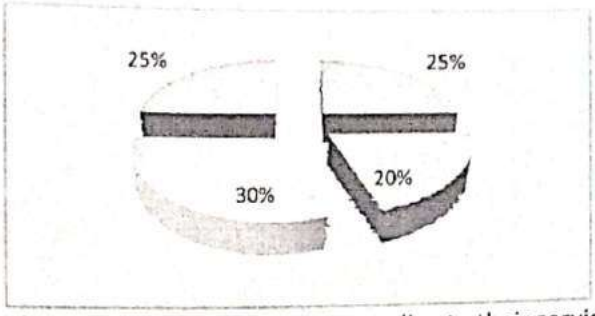

Fig 1: Ratio proportion of employees according to their service span.

Interpretation-
The employees' stability in the organization is good.

ii) What degree of stress do you feel in your job?
a) Nilb) Lowc) Intermediated) Extreme
Response

	Nil	Low	Intermediate	Extreme	Total
Employee Percentage	30	35	25	10	100

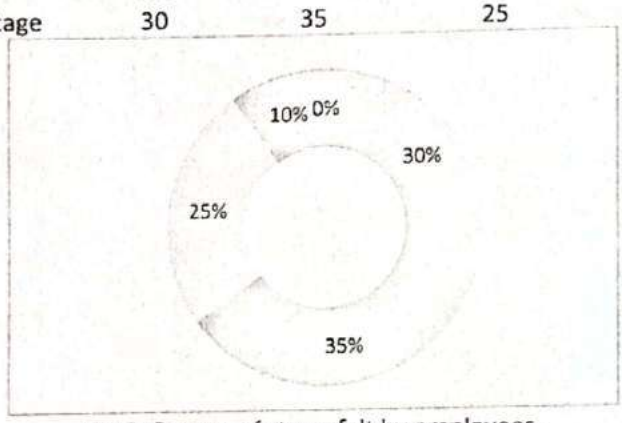

Fig 2: Degree of stress felt by employees.

Interpretation-
Stress level is a reality in Makra group of industries and deserves consideration of management.

iii). Whichone of the following you think causes stress?
*a) Work loadb) Work timingsc) Interpersonal relationshipsd) Meeting targets*e) Ventilation
Response

	Work load	Work timings	Interpersonal relationships	Meeting targets	Ventilation	Total
Employee Percentage	30	20	15	25	10	100

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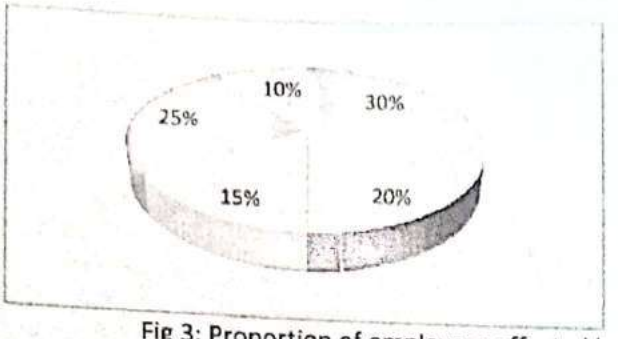

Fig 3: Proportion of employees affected by different causes of stress.

Interpretation-

Meeting targets and workload seem to be the principal causes of stresses in Makra group.

iv). In which of the following areas do you face problem due to stress in your job?

a) Healthb) Psychologicalc) Meeting targetsd) Work itself

Response

	Health	Psychological	Meeting targets	Work itself	Total
% of employees	25	20	30	25	100

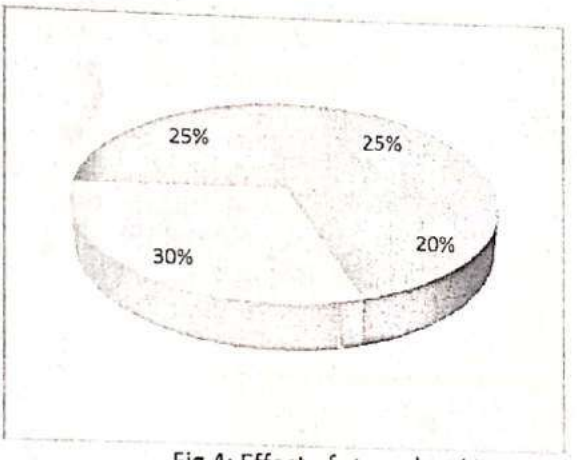

Fig 4: Effect of stress level in terms of health and performance.

Interpretation-

It is clear that the employees are unable to perform well due to stress issues affecting them health wise and psychology wise.

v) Are you comfortable with the working environment?

a) Extremely comfortableb) Comfortable c) Less comfortabled) Not comfortable

Response

	Extremely comfortable	Comfortable	Less comfortable	Not comfortable	Total
% of employees	30	35	25	10	100

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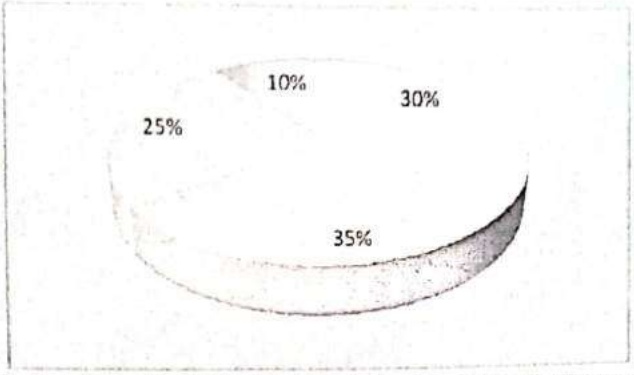

Fig 5: Employees' satisfaction level about working environment.

Interpretation-
In general the employees are satisfied with the working environment.

vi) Do you get frustrated due to excessive stress in your job?
a) Alwaysb) Many a timesc) Rarelyd) Never
Response

	Always	Many a times	Rarely	Never	Total
% employees	30	35	25	10	100

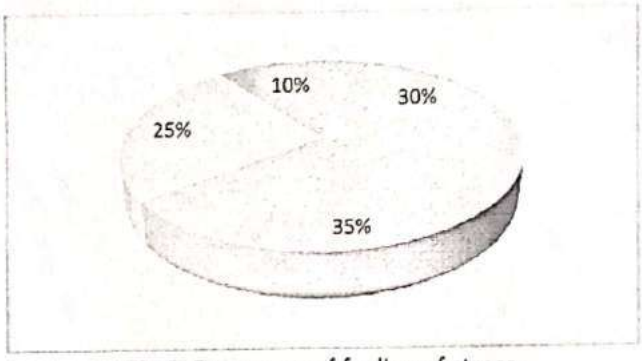

Fig 6: Frequency of feeling of stress.

Interpretation-
Frequency of occurrence of stress is very common

vii). Is all stress generated having its origin in the work place or home place?
a) Work placeb) Home placec) Both
Response

Options	Work place	Home place	Both	Total
% employee	25	15	60	100

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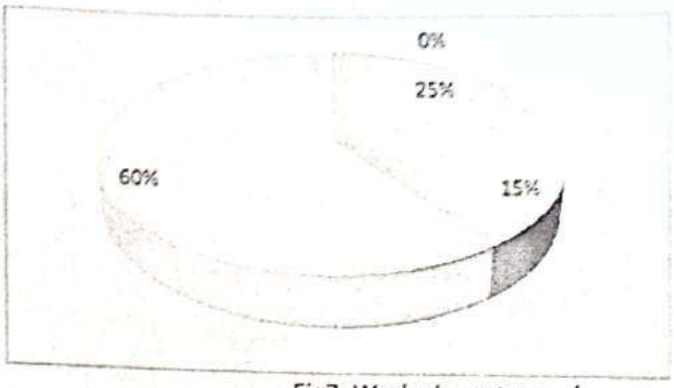

Fig7: Work place stress v/s personal stress

Interpretation-

Major source of stress is work place yet personal source is also significant.

viii). How do you think stress in the work place can be stopped?

a) Flexible work hoursb) Distributed work loadc) Timely targetsd) Periodic relaxation

Response

	Flexible work hours	Distributed work load	Timely targets	Periodic relaxation	Total
% of employees	30	35	25	10	100

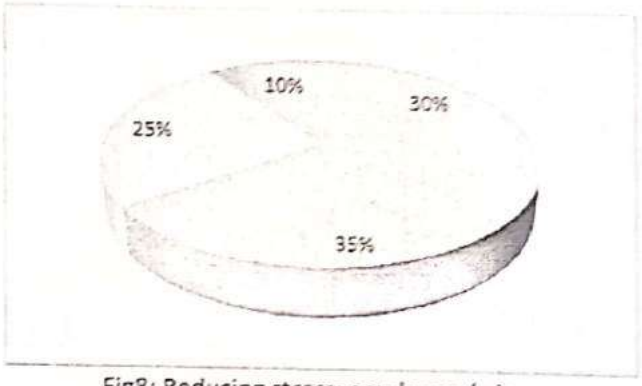

Fig8: Reducing stress: employees' view.

ix. Do you think work stress management improves morale and goodwill of the employees?

a) Very muchb) Much c) Littled) No

Response

	Very much	Much	Little	No	Total
% of employees	50	30	15	5	100

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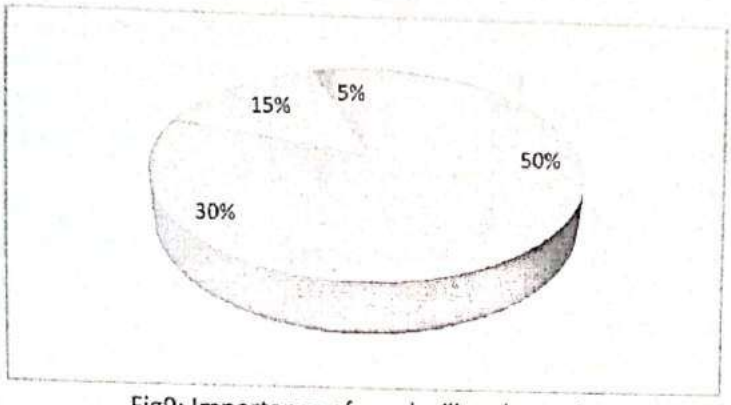

Fig9: Importance of good will and morale.

Interpretation –

The employees believe that employers' goodwill and morale are very important to reduce stress.

x. What measures do the employees suggest to be most important in controlling the stress?

a) Counselling b) Job rotationc) Leisure breaksd) Informal relationships e) Recognition of good work

Response

Options	Counselling	Job rotation	Leisure breaks	Informal relationships	Recognition	Total
% of employees	15	20	30	20	15	100

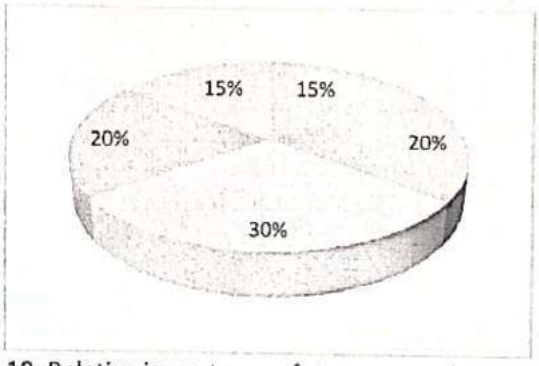

Fig 10: Relative importance of stress control measures.

Interpretation-

Most of the employees believe that leisure break is an effective method to control stress.

Xi). Which recreational activities helps you reduce work stress?

a) Family toursb) Fun partiesc) Recreational toursd) Honoring the hard working people

Response

	Family tours	Fun parties	Recreational tours	hard working people	Total
% of employees	45	30	10	15	100

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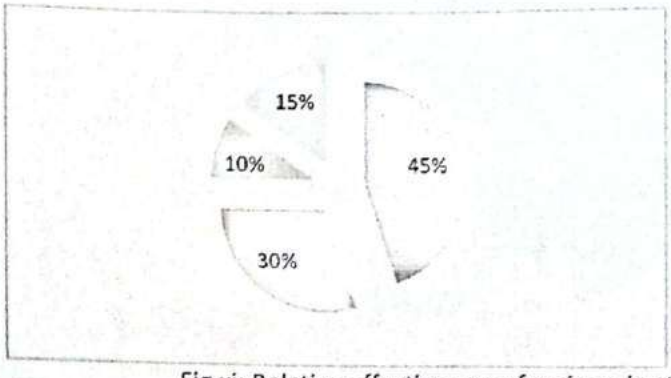

Fig xi: Relative effectiveness of various de-stressing measures.

Interpretation-

Employees have preferred family tours as the most important stress reliving activity.

xii). How often should your company provide recreational activities?

a) Yearlyb) Half yearlyc) Quarterly

Response

	Yearly	Half yearly	Quarterly	Total
% of employees	-	-	100%	100

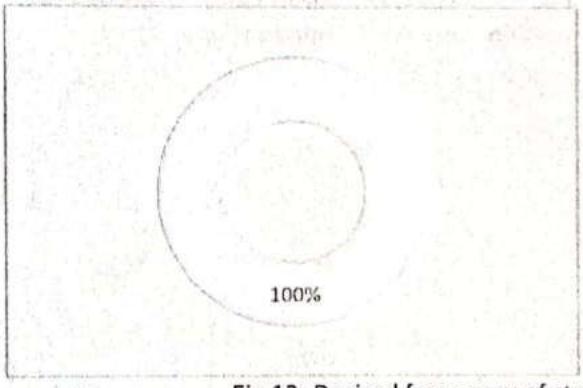

Fig 12: Desired frequency of stress reliving activities.

Interpretation-

The employees want the stress reliving activities to be more often.

5. Summarized findings:

The stability of employees in organization is appreciable. The employees in general are neutral with the physical and psychological working conditions of the organization, while considerable stress level is seen in the organization. Respondents are of the opinion that stress can be controlled by flexible job hours and workload division.All respondents prefer excursion tours to manage stress and improve relation amongst colleagues and management.Most of the respondents are satisfied with the steps taken by management.

6. Suggestions for improved HR practices in the Makras:

These include:

- ✓ Taking responsibility forimprovingphysical and emotional well-being of employee.

- ✓ Avoiding pitfalls by identifying knee jerk habits and negative attitudes that add to the stress employee experience at work.
- ✓ Management should establish communication with workers.
- ✓ Management should monitor stress levels, investigate the causes and explore potential solutions.
- ✓ Management should appoint a full time HRM to promote emotional well-being.
- ✓ Management should have managers who lead by themselves.
- ✓ Mangers should get to the office a little earlier.
- ✓ Management should create a space for quiet time or meditation.
- ✓ Management should encourage or create social activity/team building/laughter

7. Conclusions

Stress beyond limits is a killing factor for the organization. The present study has found that theMakra group of industries is one of the successful companies contributing well to the regional economy.Makra group has adopted few innovative techniques to relieve stress of their staff viz family tours, sports activities, fun parties, recreational tours, and so on. Yet there is a need to establish communication amongst workers and management, develop understanding and to move rapidly on the path of development.

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Stress Management at Work Place

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Abstract: Stress at workplace is inevitable. In true sense, stress to a limited extent is a motivational force. It is a driving agency in an organization. Yet when the stresslevel crosses the limits, it exhibits negative effects. Due to negative effects the worker loses efficiency. It has direct impact on the productivity and overall output of the system. Hence the organization should identify the sources, causes and types of stress and should keep no stone unturned to overcome stresses. The present paper reviews these factors and summarizes them. Traditional Indian concept of stress management has been discussed and its present day relevance has been explored.

Key words: Concept of Stress, Causes of Stress, Effects of Stress, Stress Management.

1. Introduction:

Stress is a state of mental tension and worry caused due to problems in life, work, etc. it is something that results into strong feelings of worry or anxiety, physical force or pressure [1]. The figure 1 explains the concept very nicely:

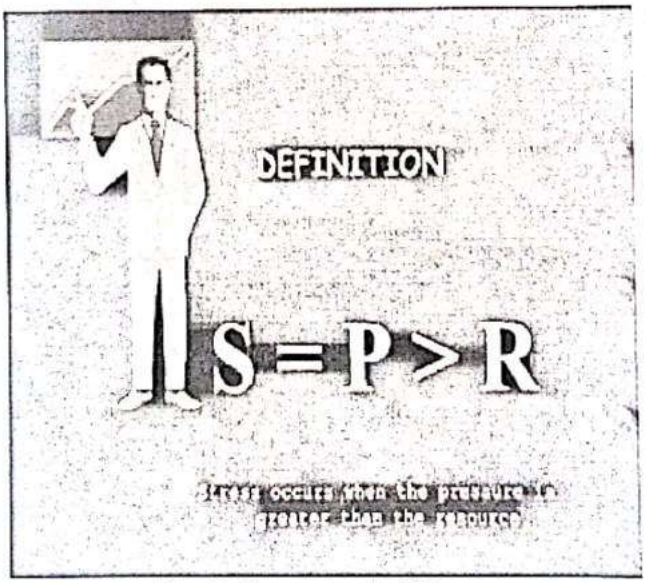

Fig.: 1: The concept of Stress.

It is a well-established perception that stress reduces the work efficiency. Due to stress the system gives less output. It may affect the health of worker and make it unfit physically or mentally. The problem may gradually percolate to the family of worker. In view of this every organization must know the sources, causes and types of stresses and the control measures to stop them. The present paper has summarized these aspects. It is hoped that this is going to be of practical use to organization dealing with work force issues.

2. Concept of stress

It is we label the situation as "stressful" and generate with the classic "stress response." If we decide that our coping skills outweigh the requirements of the situation, then we don't see the situation as "stressful" [1].

Stress may arise out of any situation or thought that pushes you feel frustrated, angry, or anxious. Everyone visualises the same situations differently. Every one has different types and levels of coping skills. So no two people will respond exactly the same manner to a given situation. Sometimes we may feel that situations are "stressful" because we are not well prepared to deal with them. Stress is a normal part of life.

Moreover not all situations that are labelled "stressful" are negative [2]. In limited extent, stress is good; it can motivate you. In fact excess of it is harmful. In true sense, , stress management is not about learning how to avoid or escape it, but to learnto appreciate how the mind reacts to these pressures. It is to learn how to develop skills which enhance the mind -body's adjustment.

3. Sources of stress

The following are the main sources of stresses [3]:

Environmental – the ambience bombards you with demands. The demands are intense and competing. One has to adjust with demands. Examples are uncomfortable weather, work place noise levels, overcrowding, some kind of pollution, traffic problems, unsafe and substandard housing, associated crimes.

Social –one has several social roles to play at a time. Like parent, spouse, caregiver, and employee or many others. All the roles demand and create stresses. Deadlines, financial issues, interviews, presentations, disagreements, etc are some sectors which may demand your time and attention. Loss of a loved one, divorce, and co-parenting are also issues causing social stress.

Physiological – Situations and circumstances affect our body. They are called as physiological stressors. There are a few examples of physiological stressors like rapid adolescence, menopause, sickness, aging, giving birth, accidents, sleep disturbances, no exercise, malnutrition etc.

Thoughts – the situations ate interpreted by brain. The interpretation may be stressful, difficult, painful, or pleasant. Though some situations at work place are stress provoking Ultimately it is our thoughts that determine whether the situations are stressful or not.

4.Types of stresses

Stressor are the situations that are considered stress provoking. Stress is not always with negative impact. Stress is simply the body's response arising due to changes that create

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taxing demands. There is a difference between what we perceive as positive stress, and negative stress. The term stress is often used to narrate the negative situations. This leads an erroneous belief that all stresses are bad, which is not true. Table 1.1 enlist the characteristics of positive and negative stresses [4].

Table 1.1: Stress characteristics

Positive stress characteristics:	Negative stress characteristics:
✓ Motivation, focusing of energy	✓ Anxiety and concern
✓ short-persistence	✓ short or long persistence
✓ Within our coping abilities	✓ outside our coping abilities
✓ Gives feelings of excitement	✓ Gives feelings of displeasing
✓ Improvement in performance	✓ Decreased performance
✓ No negative effect on mind or body	✓ Can lead to mental and physical problems

It is important to note that different people will have different perceptions and reactions to particular situations. The categorization given in table 1.1 is just general.

5. Occupational stresses

World Health Organization's (WHO) has given definition of occupational stress:

People may come across with work demands and pressures at the work places. Sometimes the intensity of demand are not matched to their knowledge and abilities. Occupational or work-related stress arises at such times. It is the responsepeople generate at such occasions. When the work is well-designed, organized and managed, it is good for the workers. When the attention to job design, work organization and management is insufficient, it can result in occupational stress.In fact when the persons are unable to cope with the demands being placed on them they develop occupational stresses.

6. Causes of occupational stresses: there are two categories, organizational and non organizational. When the parameters are in control of organization the stresses are termed as organizational.

7. Organizational causes:

Career Concern: Unfulfilled career expectations of employee are major sources of stress. If s/he feels that s/he cannot out compete others in competition, s/he feels stressed..

*Role Ambiguity:*When an employee is confused about his/her role in the organization s/he is in the state of stress.

*Rotating Shifts:*Change in shifts of work affects psychology. It may lead to disturbed personal and family life. Stress may occur due to this.

*Role Conflict:*sometimes the job demands a type of behaviour that is against the employee's moral principles. It leads to stress.

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Occupational Demands: Some jobs involve risk and danger. They are more stressful. Jobs requiring constant monitoring of equipment and devices, making decisions, etc are leading to stresses.

*Lack of Participation in Decision Making:*Employees feel neglected if they are not taken in confidence in the decision making process. Involvement of employee's in decision making sets up a better understanding in the organization.

Work Overload: Excessive work load may lead to stress. Work overload may be qualitative that is performing a job that is beyond the employee's capacity, of quantitative work overload when number of activities to be performed in the prescribed time are too many.

Work Under load: In this case, very little work or too simple work is expected on the part of the employee. Doing less work or jobs of routine and simple nature would lead to monotony and boredom, which can lead to stress.

Working Conditions: simple things like poor lighting and ventilations, unhygienic sanitation facilities, excessive noise and dust, presence of toxic gases and fumes, inadequate safety measures, etc. may lead to stresses in the employee.

Lack of Group Cohesiveness: A group exists functional due to its cohesiveness. Lake of cohesiveness lead to stress in the group members.

*Interpersonal and Intergroup Conflict:*there are differences in perception. They lead to interpersonal and intergroup conflicts. Difference in attitudes, values and beliefs may also lead to the same thing.

*Organizational Changes:*employees may exhibit certain degree of redundancy in terms of adaptability tom changes. Simply change in technology may lead to stresses.

Lack of Social Support: When individual employeesfeels that s/he has the friendly support of others at work, his/her ability to cope with the effects of stresses increases. Else, vice versa takes place.

8.Non organizational causes:

*Civic Amenities:*poor civic facilities like improper water supply, excessive noise or air pollution, lack of proper transport facility etc in the region the employee lives, can be a cause of stress.

Life Changes: Life changes can bring stress to a person. Life changes can be slow or sudden. Slow life changes include getting older and sudden life changes include death or accident of a loved one. Sudden life changes are highly stressful and very difficult to cope.

Frustration: Frustrations arise due to barriers in the goal. They need to be removed by the top level management.

Caste and Religion Conflicts: unfortunately the employees facing discrimination on the basis of caste and religion do suffer from stress. Particularly in India it is a considerable issue.

Personality: some people are feel guilty while relaxing, get irritated by minor mistakes of self and others, feel impatient and dislike waiting and do several things at one time.While theothers are exactly opposite. They are less affected by stress.

*Career Changes:*An employee suddenly switches over to a new job. s/he is under stress of new responsibilities. Under promotion, over promotion, demotions and transfers can cause stress.

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9. Effects of stresses:

Stress badly affects the productivity, performance as well as physical and emotional health of employee. Symptoms like fatigue, headache, upset stomach, muscular aches and pains, chronic mild illness, sleep disturbances and eating may appear due to occupational stress. Anxiety, irritation, drug addiction, feeling of powerlessness, low moraleetc are Psychological and behavioral problems that may arise.

10. Stress management at workplace:

In some countries, it is the legal responsibility of employers to identify and deal with stress in the workplace so as to prevent that employees becoming physically or mentally ill [6].

It is important to know causes of stress in the workplace and to deal seriously with them. Else the stress at work can cause problems for the individual employee, working relationships and the overall working ambience. In sum total it may result into lowered self-esteem and poor concentration level for the employee. The employer may have to face increased customer complaints, and loss of manual outputs.

11. Benefits of stress management:

Joshua (2012) *et al* has identified following benefits of stress management in organization.

- Motivation to employees
- Increases in productivity
- Meeting of deadlines
- Suppression of unethical issues
- Reduced workplace conflicts
- Strengthened communication
- Smooth running projects
- Improved team spirit

12. Conclusions

Hence it can be concluded that work place stress is a very important issue. It may lead to damage of employee as well as employer side. Hence a good organization should identify the causes and sources of stresses and take appropriate remedial measures to remove them. The organization doing so will gain in terms of enhanced productivity, improved performance of workers, overall growth and employee satisfaction. Stress management doesnot require big investment in monetary terms. It requires skilled approach of management. Stress management may be a crucial factor in success of an organization.

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Production Planning and Control at Mass – Tech Controls Pvt Ltd, Jalgaon: A Case Study

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Abstract:

Success of an manufacturing unit depends largely upon understanding the dynamic equilibrium between demand and supply and optimal utilization of all resources including man, machine, material and money. Optimum utilization leads to increased efficiency. Due to this the quality of product is enhanced while the cost is reduced. This results into market victory. The strategy is simple. The present work is case study on production planning and control (PPC) in an electronic industry named Mass Tech Controls Pvt Ltd, Jalgaon. The entire process of PPC in the industry has been thoroughly and vis.-a-vis. assessed through primary and secondary data sources. Based upon this the points of success and un-success of PPC implementation have been highlighted and suggestions have been given to overcome points of un-success. If implemented properly the PPC suggestions will improve product quality hence the profit of the organization. It will also be a useful database for similar other industries.

Key words: Production Planning and Control, Case Study, Efficiency.

1. Introduction:

Dr Ajay Mishra (2023) has defined Project Management and Control Techniques as A project plan is the glue holding the components of a project together for a successful outcome. Thus the project plan will enable the manager to easily assign tasks, monitor progress and costs as well as communicate project status to interested parties and produce reports [1]. PPC ensure better performance. It ascertains better outcome and higher efficiency. PPC does not talk of maximisation, it talks of optimization for higher overall outcome. There are four important PPC techniques: brain storming, cause and effect diagram, critical path analysis and Gantt charts.

1.1 Brainstorming: technique focuses creativity and help the team discover solutions. In this techniques all concerns sit together for an open minded discussion. It is a creative process designed to encourage random and lateral thinking. Brainstorming useful for highlighting potential problems and raising concerns that do not seem obvious immediately [2].

1.2 **Cause and Effect diagrams:** they are also known as "fishbone" or Ishikawa diagrams. They are especially useful or gathering and identifying all issues that may be problematic. They give an instant overview of the components of a project in a clear way. A view not hampered by bottlenecks like schedules, dependencies and milestones [3].

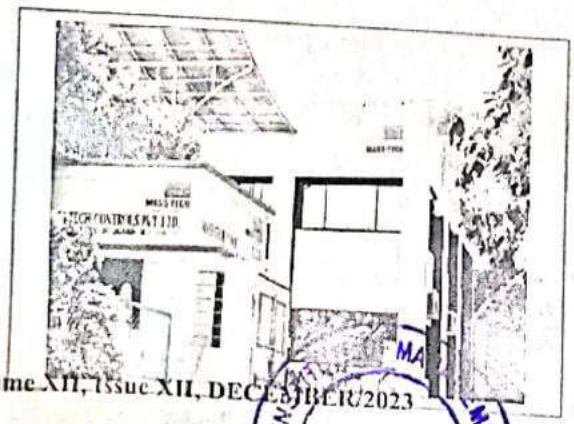
1.3 **Critical Path Analysis:** large and complex projects involve a large number of activities that could be performed in parallel and are interwoven also. Critical Path Analysis' is a very effective technique to describe mutual dependencies of activities.it helps in finding out priorities [4].

1.4 **Gantt chart:** throughout the project it is used for scheduling and monitoring tasks, for showing costs and expenditure at all stages. It is also used for communicating progress and producing reports. Being diagrammatic they are easy to interpret [5].

The PPCs mentioned above are the most widely accepted PPCs. Many authors have mentioned other techniques of PPC also. The industries which apply the PPC techniques, perform better. They lead the market. The present work is related with the industry Mass Tech Controls Pvt Ltd, Jalgaon. The overall performance of the industry has been examined in the light of PPC and suggestions are given for improvements.

2. The Industry under study:

Location map and front view of the industry Mass -Tech is given in fig. 1. The industry was established in 1993 [6]. Initially it focused on production of DC Systems. Gradually Mass -Tech has been arose as a leading manufacturer of Battery chargers, Convertors and Low voltage switchgear and Control panels. The industry has established ties with Indian Electrical Power Industry slowly yet steadily in a planned manner. It has technological collaboration with companies like FRONIUS (Austria) and CONVERTRONIC (Germany).



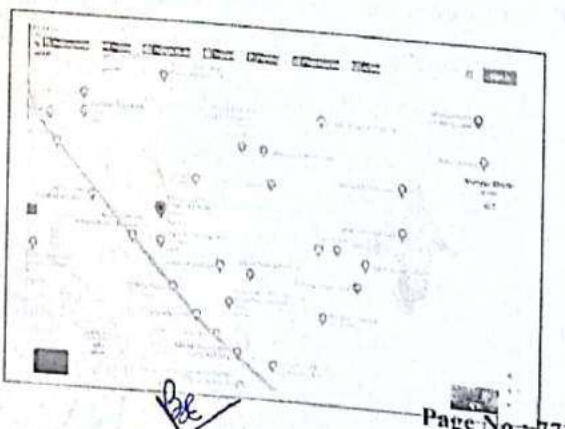


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Fig 1.: Location sketch and front view of Mass Tech Controls.

The company wants to achieve continual growth through sustained innovation for total customer satisfaction and fair return to all other stakeholders. In order to meet this objective focusing on producing quality products at optimum cost and marketing them at reasonable prices.

3. Methodology:

The first stage is data collection. Primary data is collected by direct observation and questionnaire. Secondary data has been collected by Internet & Websites, Business Magazines, Annual reports of company and Books. The present study data is mainly based on secondary data. The company has 210 employees with an estimated turnover of 35 crores per annum.

4. Limitation of Study:

Company's technical secrecy cannot be disclosed in this paper.

5. Strengths of the industry

Following strengths are observed directly:

Strong brand and leadership position in India

Experienced management and large pool of agriculture professionals.

Flexible and scalable business model.

Revenue generation for the year 2021 -22:

The company does not disclose the actual figures of earnings. Rather it gives the percentage production in sale of various goods prepared by it. It is given in table 1.

Table 1: Proportion of various items manufactured by the industry

Item	% Sales
DC chargers	64.7
Monitoring Units	22.6
SMPS Modules	7.5
Inverters	1.6
Other products	2.6

6. Internal Controls and Management Information Systems

6.1 ERP

The company has used E R P software platform. It has enabled simplified and standardized work processes across all facets of company's complex and diversified businesses. It has further enhanced the customer service culture and operating efficiencies.

6.2 SAP

SAP implementation has allowed a number of strategies to be implemented in internal control of the business application. It is done through process mapping, segregation of duties, authorizations.

6.3 Prospective Plan

The industry is going to integrate its infrastructure by rolling out SAP at foreign subsidiaries to further streamline manufacturing, supply chain, local and global reporting, and analysis in a common enterprise wide format. This will result into better collaboration with globally scattered units, and global operation will be more transparent and efficient.

6.4 Internal audit

It is a usual tradition of industry.

6.5 Quality Policy

The industry is ISO 9001-2000 certified. It rigorously tests final product before dispatch.

6.6 Steps in Production Planning and Control (PPC)

6.6.1 *Production planning*

The company does lot of research for doing production to meet annual demand and to avoid any dead blockage [7].

6.6.2 *Routing*

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Routing defines the operations, their path and sequence. Accordingly required machines and man power are worked out. The company does this exercise very meticulously [8].

6.6.3 Scheduling

In this process the time required for individual components of processes is estimated considering various factors. Then the time required for complete route is determined. Company has established it. Production schedule, master schedule and manufacturing schedules are prepared [9].

6.6.4 *Loading*

Who will do the work as routing determines where is determined by loading. The industry does it carefully being a small organization where everyone has to do multitasking without alternatives available [10].

6.6.5 Production control

It starts with dispatching and ends up with corrective actions. It is the process of planning production in advance of operations, establishing the extract route of each individual item part, setting, starting and finishing for each important item, assembly or the finishing production and releasing the necessary orders as well as initiating the necessary follow-up. This ensures the smooth function. The industry under study has good production control.

6.6.6 Dispatching

It involves movement of materials, tolls and fixtures between workstations, beginning of each operation, recording of time and cost involved in each operation, flow of work from one operation to another in accordance with the route sheet, and inspecting of work [11].

6.6.7 Follow up

It involves determination of the progress of work in flow of work, removing bottlenecks and ensuring productive operations to go on with the plans [12].

7. Questionnaire Survey and interpretation:

(i) Do you think production planning and control is central to the success of any manufacturing unit?

Response:

Options	Yes	No
Response	210	0

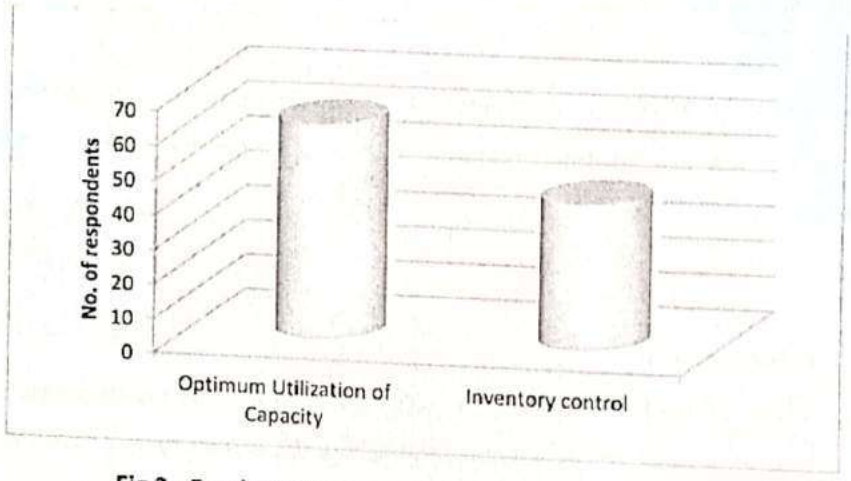

Fig 2.: Employees response about importance of PPC.

It can be seen that the employees are very well aware of the importance of PPC techniques. *(ii) Capacity planning should be done for the efficient use of facilities and equipment in Mass-Tech?*

Options	Yes	No
Response	168	42

It can be seen that the employees are in favor of capacity planning to be adopted by the industry.

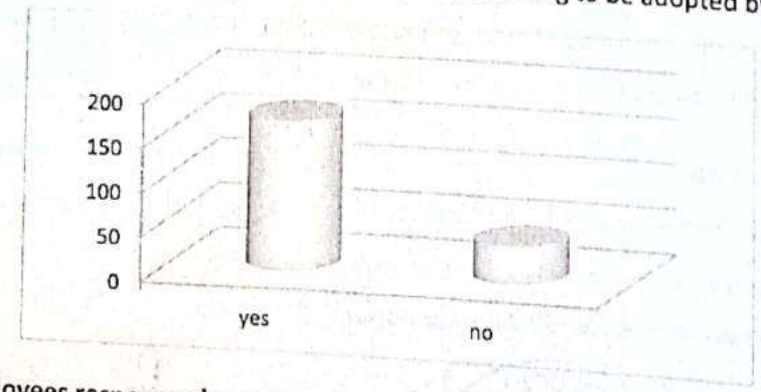

Fig 3.: Employees response about necessity of capacity building initiatives in the industry.

(ii) What is the main objective of Production Planning in your view?

a) Optimum Utilization of Capacity

b) Inventory control

c) Economy in Production Time

d) Ensure Quality

e) Waste reduction and increased profit

Options	A	b	c	d	E
Response	62	42	48	58	20

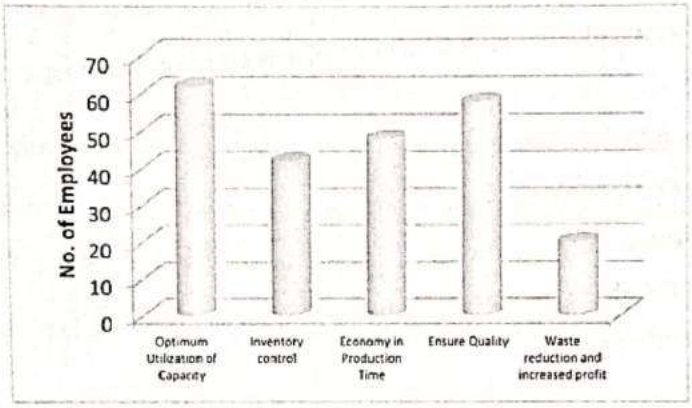

Fig 4.: Employee response regarding relative importance of production planning components.

All the respondents believe that optimum utilization of capacity and quality ensuring are the main objectives of production planning.

The other objective of production planning is inventory control, economy in production time, and quality insurance.

iv) Are you aware that the Production Planning and Capacity Planning are interrelated?

Options	Yes	No
Response	140	70

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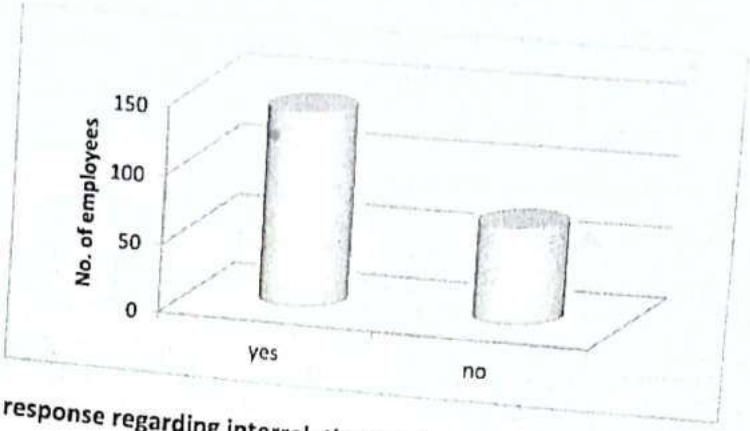

Fig 5.: Employee response regarding interrelationship between production planning and capacity building.

Majority of the respondents i.e. 70% believe that production planning and capacity planning are interrelated.

v) *What are the effects of mismatch of load and capacity?*

a) Lead time get affected

b) Increase in cost

c) Hurts the ability to satisfy customers

d) Other effects

Options	a	b	c	d
Response	0	80	110	20

Majority of respondents believe that the mismatch will hurt the ability to satisfy customers and may lead to cost increase.

vi) *On what basis do you plan your production?*

a) Customer needs (demand)

b) Target of Marketing Dept.

c) Resources available

d) Other factors

Options	a	b	c	d
Response	90	0	120	0

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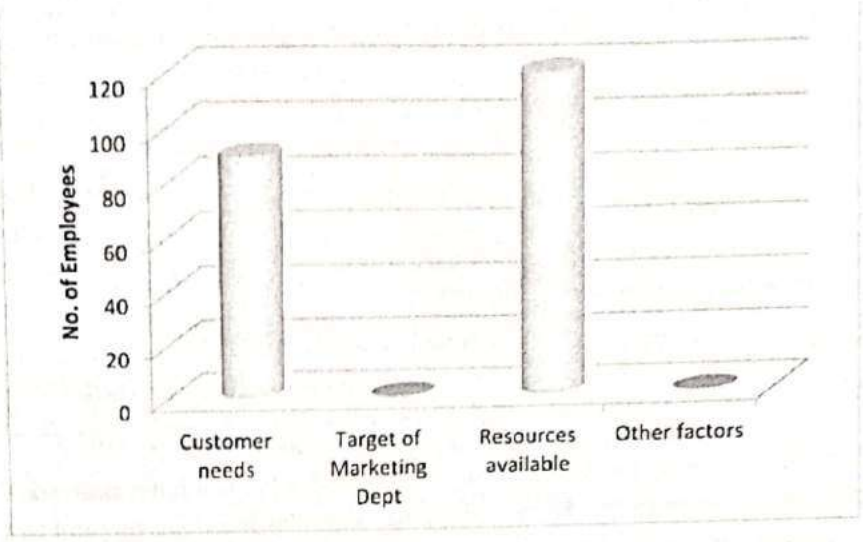

Fig 6.: Employee response regarding relative importance of bases for production planning.

Employees give more importance to customers' need and resources available for production planning. Target of marketing department and other factors are nil.

vii) *Do you feel "hung up" and "bottlenecks" in implementing Production Plans in your organization.*

a) Yes

b) No

Options	Yes	No
Response	80	130

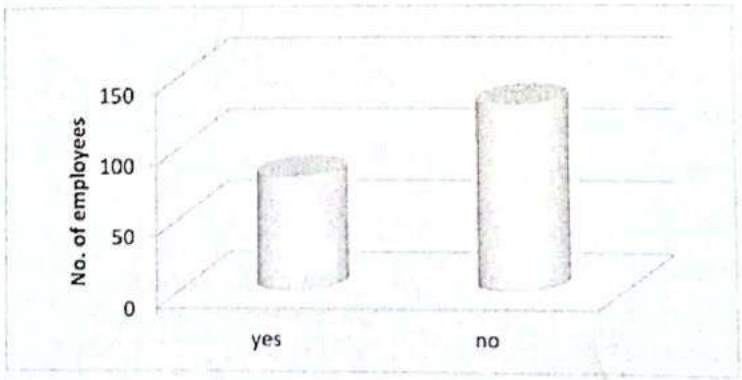

Fig 7.: Employee response regarding prevalence of bottlenecks.

Though the majority feels that there is no bottleneck observed in implementing production plan, there is a considerably large number which feels that there are bottle necks.

viii) What are the bottlenecks?

a) Material unavailability
b) Delay in transport
c) Lack of coordination between departments
d) Stringent quality standards

Options	a	b	c	d
Responses	80	70	50	10

It is evident that the majority of employees consider the bottlenecks as material supply and transportation delays. Some also consider the departmental lack of coordination as bottleneck. But a very few believe that quality standards are also reason.

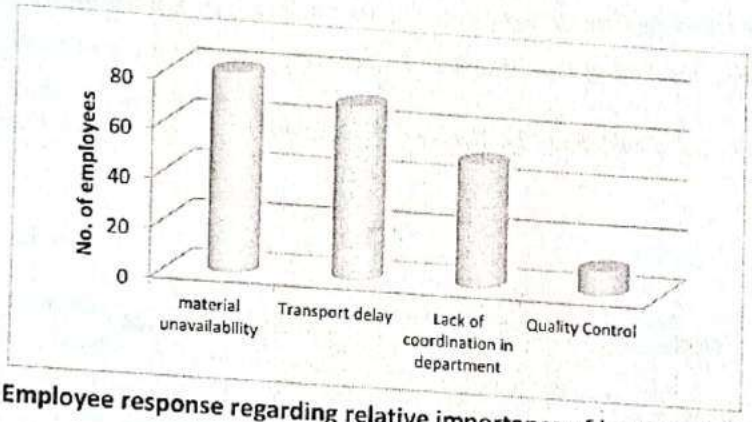

Fig 8.: Employee response regarding relative importance of bottlenecks in PPC implementation.

ix*) If the outputs are not according to the plans, what control measures need to betaken?*

a) Revision of Plan
b) Extra working to achieve target any how
c) Expert advice
d) Any other measures.

Options	Revision of Plan	Extra working to achieve the target anyhow	Expert advice	Other measures
Response	195	10	5	0

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Authored by

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Analysis of cash flow in a bank: a case study of Jalgaon People Cooperative Bank, Jalgaon

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Abstract: The cash flow is a statement which depicts change in cash position, along with its reason, over a period of time. This helps in planning to the management in making plan. This statement assesses the ability of the enterprise to generate and utilize the cash. It is one of the tools for assessing the liquidity and solvency of the enterprise. In case of banks, the cash flow is like a dynamic process and equilibrium has to be made judiciously Cash flow in a bank is a complex function of Operating, Financing and investing activities. The bank management has to ensure a dynamic equilibrium between these activities.

The present work is a case study for Jalgaon People Cooperative bank. It is a very reputed and trusted bank of Maharashtra. The present work has critically examined the cash flow in the bank. The impact of the Operating, Financing and Investing activities on bank cash resources has been investigated. Suggestion and views are given for strengthening the same.

Key words: Cash flow, Bank, Statement.

Introduction:

Varshney and Jain [1] have defined cash flow as the final module of a concern's annual report which helps in identifying the cash generating ability of any enterprises. The same is affected by major activities like Operating, Financing and Investing on cash resources. In a business organization a cash flow statement is important because the same is used to access the timing, amount and predictability of future cash flows. This is the basis of budgeting. Cash flow investigation in a bank is very critically important [2]. Banks are financial institution accepting deposit from public and lending them who are in need. Banks help economy to groom and assist the nation to develop. They help creating equitable society in the nation through helping the industries, trade and agriculture.

When banks collapse, people loose their faith in economy and economy drops rapidly [3]. Hence it is necessary for the growth of secured economy that the bank activities are duly monitored [4].

The present work is pertaining to Jalgaon People Coperative Bank, which is a reputed bank of region.

2. Profile of the Jalgaon People Co-Operative Bank

It is a cooperative bank regulated by Reserve Bank of India and registered under the States Cooperative Societies Act [5]. Ficus rligosa (pipal) is the symbol of this bank. It came in existence in 1933. Late Shri Rao Saheb Rupchanda Lathi, Shri S.V. Deshpande & Shri Mishrialji Joshi established the bank. It was under the leadership of Shri Kaka Saheb Patil (Vice President) in 1948 that the bank got its operational momentum. In 1969, Late Shri Yashwantrao Patil (Chairman) extended the bank's areas of operation. In 1994 at the time of diamond jubilee of the bank, and recorded a profit on Rs one crore. Later The Bank got Grade-I Reward by the RBI.presently the bank has over 40 number of branches, 22139 share holders, 1649 nominal share holders, and a share capital of 2529 Lakh Rs. There are saving deposits of Rs 50248 Lakh Rs and Fixed deposits of 95520 Lakh Rs. Secured and unsecured loans are respectively 84594 Lakh Rs and 1735 Lakh Rs. The NPA is around 6%. There are 354 regular employees and 72 sub employees. The bank customers are individuals, Farmers, Industrialists and Others.

Methodology

There are basically two components of research in this work, data collection and analysis. Data collection is done through records, ledgers, files, websites etc. Analysis is done by Microsoft Excel.

Results and discussion:

The present work has analysed and presented relevant data to cash flow of the bank for three years, 2020 – 2, 2021 – 22, and 2022 – 23.

Fixed assets

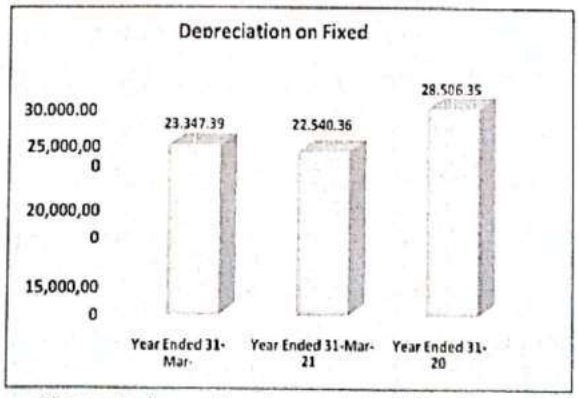

Figure 1 shows the depreciation fixed assets

Fig 1: Trend of fixed deposits.

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The FD amounts is slightly less compared to year 2021 because there is sale of fixed assets in year 2022 as per records.

Non performing investments

For a stable function of banks, there must be due provision for non performing investments too [6]. The provision is as shown in figure 2.

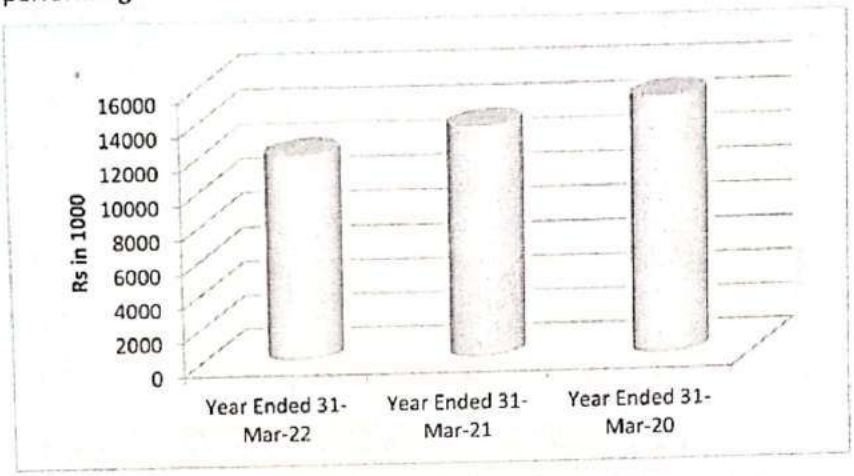

Fig 2. : Provision for non performing investments

From the figure 2, it is observed that, there is decreasing trend in Provision for Non-performing investments. This happens due to decreases in customers of bank.

Operating Profit before working capital changes

Operating Profit before working capital changes [7] is an important parameter for banks to assess cash flow. The same has been done for Jalgaon People Cooperative Bank. The results are shown in figure 3.

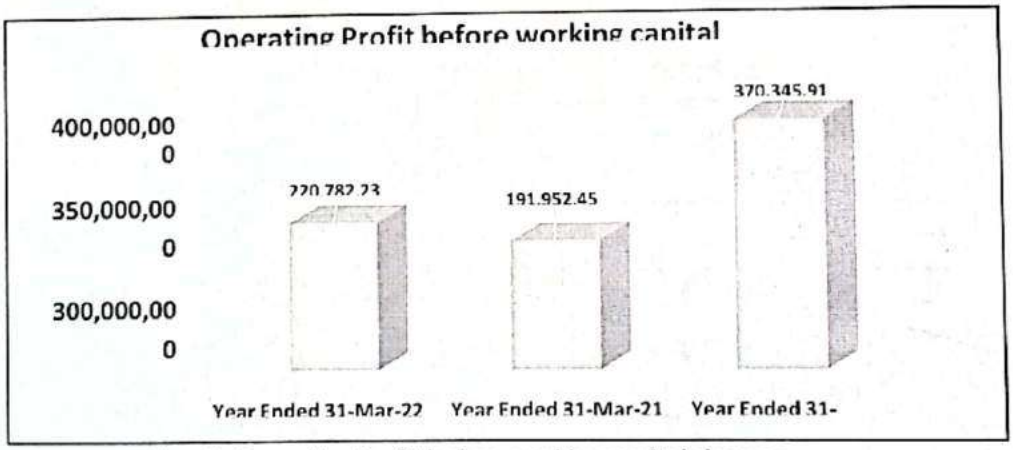

Fig. : 3: Operating Profit before working capital changes

From the above graph it is seen that operating profit taken before working capital fluctuates in some limits yet remains significantly high.

The amount of FDs available in the banks is an important parameter to assess the cash flow characteristics [7]. In the present study we see that there is a continuous rise in it.

Trend in deposits

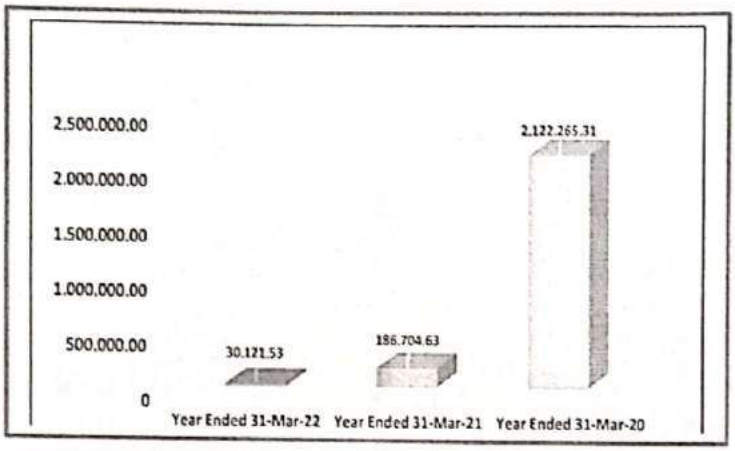

Fig. 4.: Trend in Deposits

From the above graph, it is seen that there is a decreasing trend in deposits year by year. It may be attributed to the fact that people's choices are varying with time.

Sale of fixed assets [8]

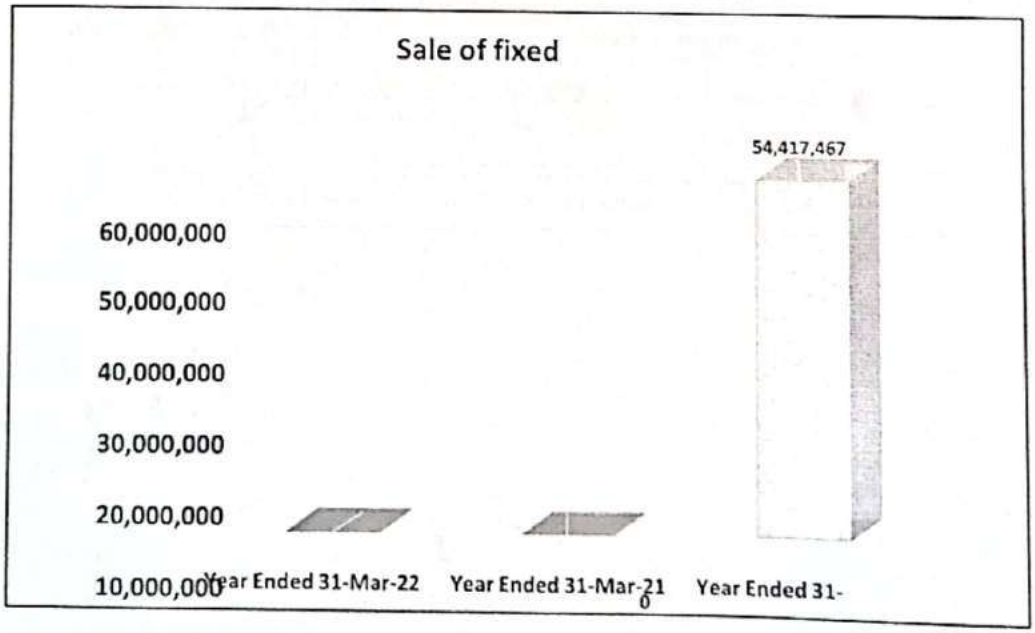

Fig.: 5: Sale of fixed assets.

This graph shows that the fixed assets which are unnecessary for the bank are sold out year by year.

Purchases of Fixed Assets

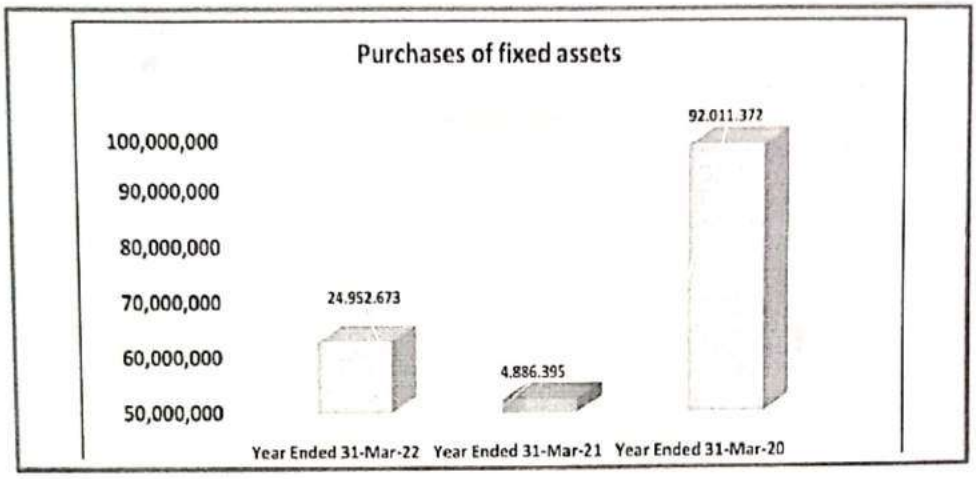

Fig 6: Purchases of Fixed Assets

This graph shows that the purchases assets in fell significantly in year 2021 yet again increased in 2022.

Increase/ (Decrease) in Borrowings

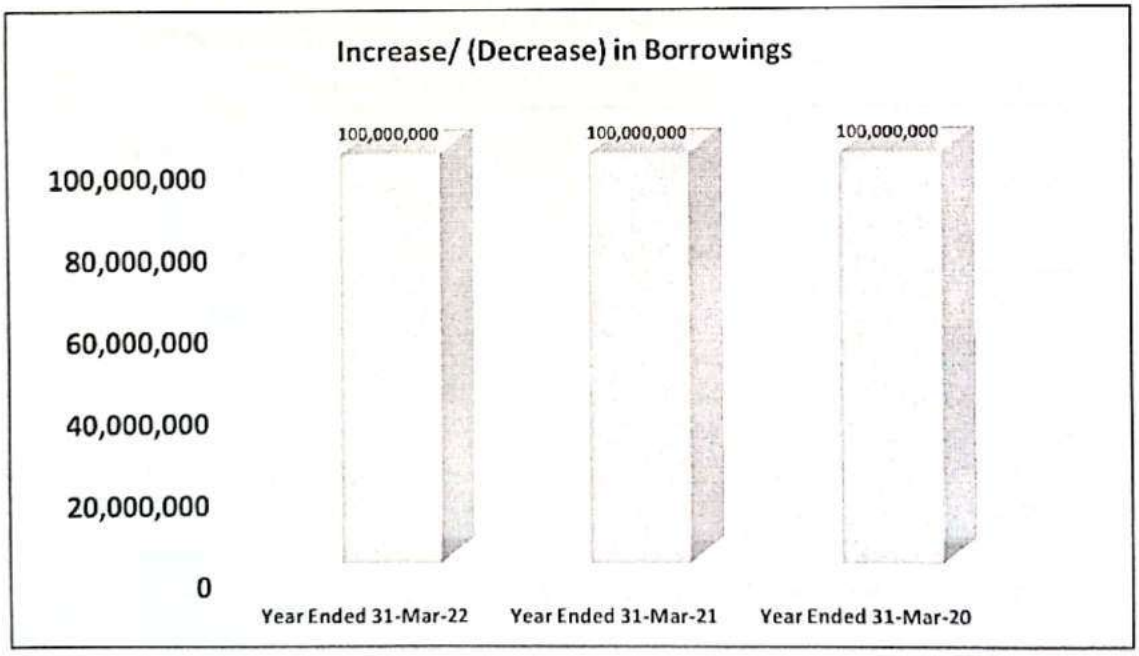

Fig 7.: Increase/ (Decrease) in Borrowings

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From the graph 7, it is observed that borrowings in year 2020,2021 and 2022 are constant value. Cash inflow is there in all the three years. In year 2020,2021 and 2022, bank opened new branches. Thereby there is increase in employees, customers, and the services banks give to their customers. Thus the bank has to borrow more money

Major Inflow and Outflow of cash

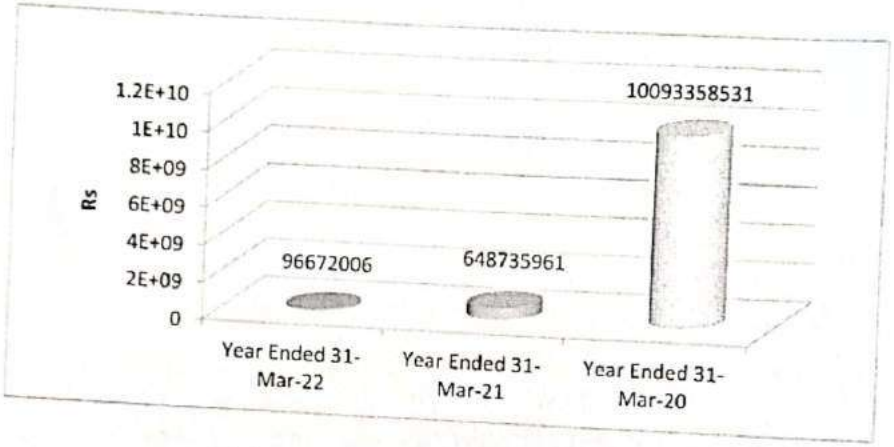

Fig 8.: Major Inflow and Outflow of cash

It is observed that in 2021, there is cash inflow which is 64,87,35,961 and in year 2022 again there is cash inflow from the operating activity. In the year 2020 there is cash outflow because of the increase in other liabilities and provisions.

Cash Flow from Investing Activities

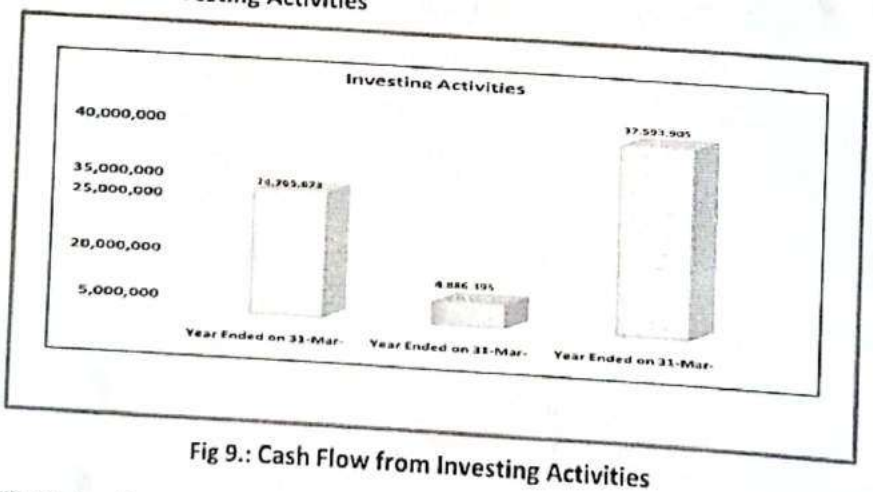

Fig 9.: Cash Flow from Investing Activities

Will Klinton (2022) has identified cash flow from investing activities as an

important indicator for cash inflow study. There are cash outflows seen because the bank invested or purchased fixed assets. investments are also there in subsidiaries joint ventures. Compared to other years in the year 2020 bank has invested more.

Financing activities:

Financing activities help in analyzing cash flow. The same for JPCB is as shown in fig 10.

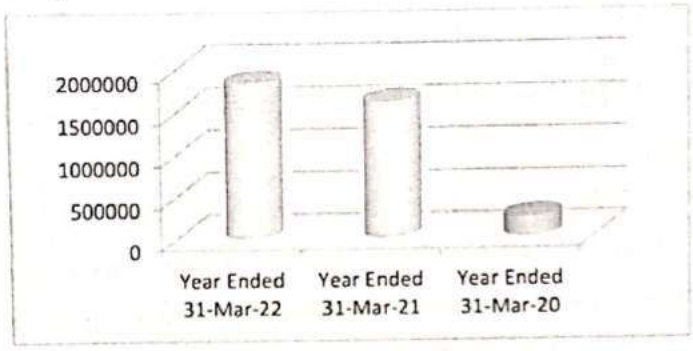

Fig 10: Financial Activities.

From fig 10 it is observed that there are cash inflows in all 3 years from the financing activities. There is increase in cash inflow in the year 2022 because there is major cash inflow from proceeds.

Summarized Findings

- The consolidated profit has increased year by year.
- There is cash outflow in year 2020 and year 2021 in operating activities. This is because of decrease in other liabilities and provisions. In year 2022, there is more decrease in other liabilities and provisions.
- As large investment is done for purchase of fixed assets and investment in subsidiaries and/or joint ventures. Hence there is cash outflows.
- In financing activities, increase in minority interest not affects the financing activity as that much compared to other activities of bank, like Proceeds from issue of shares and also proceeds from issues of upper and lower tier II capital instruments.
- In financing activities, the major affecting activity is constant value in borrowings, which is a major cash inflow for the bank.

Suggestions for improvements:

1. The bank should see that its cash is not blocked in dead assets.
2. Bank should keep some provision for non performing assets.
3. There should be increase in cash inflows from issue of upper and lower tier II capital instruments, as it plays more important role in the financing activity.
4. The bank should keep less borrowings. These are not good for the financial health of the bank.
5. Average net profit of the bank for last three financial year is ~ Rs. 500 crore.

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DESIGN AND ANALYSIS OF LADDER TYPE AUTOMOBILE CHASSIS USING FEM

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Abstract: The chassis is the one of the significant components of any vehicle as it holds the other structures such as suspension, power train, Drive train, Axle assemblies including wheel, Steering and brakes. The chassis provides necessary strength for supporting the various mechanical components. Chassis should rigid enough to withstand the shock, twist, vibration and other stresses. Chassis ensures low level of noise, vibration and harshness throughout of automobile. Before starting work on this topic various studies on the related topics were analyzed. After a careful analysis of various research studies conducted so for it has been found that there is the scope of optimizing different factors like weight, stress-strain values and deformation etc. for different materials. In the present work, the dimension of the Ashok Leyland 1618 chassis is used for the structural analysis of the heavy vehicle. A three dimensional solid Modelled in the CAE software CATIA and analyzed in ANSYS. The numerical results are validated with analytical calculation considering the stress distribution and deformation. The purpose of this work is to identify the better material for chassis on full load condition using finite element analysis. Therefore, static stress analysis is done to point out regions with highest stress for different materials.

Key words: Stress, vibration, Chassis, heavy vehicle.

1. Introduction:

The chassis provides the strength needed for supporting the different vehicular components as well as the payload and helps to keep the automobile rigid and stiff. Consequently, the chassis is also an important component of the overall safety system. Furthermore, it ensures low levels of noise, vibrations and harshness throughout the automobile. Chassis should be rigid enough to withstand the shock, twist, vibration and other stresses. Along with the strength, an important consideration in chassis design is to have adequate bending and torsional stiffness for better handling characteristics. So, strength and stiffness are two important criteria for the design of chassis. All most all components weight is acting on the chassis frame, thus chassis subjected to static, dynamic and cyclic loading condition on the road. There are different types of chassis used for different class of vehicles such as ladder, backbone, space, monocoque and their combination. All the chassis are subjected to bending load, lateral load, Longitudinal Load and Torsional load on road. In this study, ladder type chassis frame is analyzed for static stress analysis using Finite Element Analysis.

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2. Literature Review:

M Nagaraju et al. taken the dimensions of an existing heavy vehicle chassis of a TATA 1109 EX2 vehicle for modeling and analysis. The vehicle frame is initially modeled by considering "C" cross section in SOLID WORKS 2014 then it is imported to ANSYS 13.0. The analysis is done with two different composite materials namely Steel and S-glass/Epoxy subjected to the same pressure as that of a steel frame. The design constraints are stresses and deformations. The results are then compared to finalize the best among all the four frames. [1]

Anurag et al. presents the study of the stress developed in chassis as well as deformation of chassis frame. The stress and deformation has been calculated for the chassis frame and the analysis has been done for the validation on the chassis frame. The model of the chassis has been developed in Creo (Pro-E) 2.0 and static structural analysis has been done in ANSYS WORKBENCH 15.0. [2]

Tandra Naveen Kumar et al. performed manual design calculations of the army vehicle chassis initially and the same design has been validated using finite element analysis. The following analysis was carried out to study the structural integrity of the "Army vehicle chassis" under various loading conditions. Firstly, a static analysis with only equipment loads applied. Secondly static analysis in deployment mode. (The vehicle is lifted from ground with jacks. Loads on Army vehicle chassis include equipment as well as bare vehicle weight). Thirdly Modal analysis to find the Natural Frequencies was carried out. From the results obtained some changes were proposed and implemented to reduce the deflections and stresses and also efforts are made to increase the fundamental natural frequency of the chassis.[3]

Akash Singh Patel et al. used the dimension of the TATA 2518TC chassis for the structural analysis of the heavy vehicle chassis by considering three different cross-sections, Namely C, I, and Hollow Rectangular (Box) type cross sections subjected to the same conditions. A three dimensional solid Modeled in the CAE software CATIA and analyzed in ANSYS. The numerical results are validated with analytical calculation considering the stress distribution and deformation.[4]

Rahul L. Patel et al. investigated and optimized a chassis design for Weight reduction of TATA 2516TC chassis frame using Pro-Mechanica. They first find out the assembly weight, maximum stress, strain and displacement for the existing section of chassis by using ANSYS Software after then they modified the dimensions of existing C-sections and again find all and concluded that the existing "C" sections is better than all the sections with respect to the Stress, Displacement, Strain and Shear stress except the weight. For the weight consideration modified "C" section has less weight than the all sections which are studying in this paper. Finally, By the use of modified "C" section.[5]

3. Problem Definition:

The chassis selected for the Finite Element Analysis is of Ashok Leyland 1618 truck. The aim is to know the point of stress concentration on the existing material. Further efforts have been made to redistribute the maximum stress by using different materials as aluminum alloy and grey cast iron for chassis and analyze the values of stress obtained.

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The chassis specification for selected model is as follows:

Chassis type:	Cabin with chassis.
Wheel base(mm):	4,330
Overall length(mm):	7,788
Overall width(mm):	2,432
Overall height(mm):	2,900
Ground clearance(mm):	260
Chassis depth(mm):	28.2
Chassis flange width(mm):	75
Chassis thickness(mm):	6
Gross vehicle weight(kgs.):	16,200
Kerb weight(kgs.):	5,215
Payload(kgs.):	10,985

Table 1: Chassis Specification

4. Methodology

Engineering analysis can be broadly classified into two categories:

4.1.1 Classical methods

4.1.2 Numerical methods

4.1.1 Classical Methods

These methods attempt to solve field problems directly by forming governing differential equations based on fundamentals of Physics. Exact solution, those having closed forms are possible only for the simplest cases of geometry, loading and boundary conditions. A somewhat wider variety of classical problems can be solved using approximate solution governing differential equations. These solutions take the form of series expansions which are truncated after reasonably degree of convergence.

Like exact solutions approximate solutions require regular geometric shapes, simple boundary conditions and well-behaved loads. Consequently, these solutions bear little resemblance to most practical engineering problems. The principal advantage of classical methods is the high degree of problem insight provided by solutions of this type.

4.1.2 Numerical Methods

These methods address a broad range of problems. The energy method seeks to minimize an expression for the potential energy of a structure over its entire domain. This approach works extremely well for a certain problem, but this is not broadly applicable.

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The boundary element method approximates functions satisfying the governing differential equations, but not the boundary conditions. The problem size is reduced because the element represents only the boundary of the domain. However, application of this method relies on knowing the fundamental solution to governing equations, which can be difficult to obtain.
The finite differential method replaces governing differential equations and boundary conditions with corresponding algebraic equations. This permits somewhat irregular problems but complex geometry, boundary conditions or loads become difficult to handle. In this approach the body of the system is 'discretized' by mesh nodal points. Field variable (Displacement and stresses) is represented by discrete values of the variable at the nodes.

4.2 Finite Element Analysis

4.2.1 Planning the Analysis

This is arguably the most important part of any analysis, as it helps ensure the success of the simulation. Oddly enough, it is usually the one analyst leave out. The purpose of a FE analysis is to model the behavior of a structure under a system of loads. In order to do so, all influencing factors must be considered and determined whether their effects are considerable or negligible on final result. The degree of accuracy to which any system can be modeled is very much depends on the level of planning that has been carried out.

4.2.2 Pre-Processor

The preprocessor stage involves the following:
Specifying the title that is the name of the problem. This is optional but very useful, especially if a number of design iterations are to be completed on the same base model. Setting the type of analysis to be used, e.g. structural, fluid, thermal or electromagnetic, etc.

4.2.3 Creating the model

The model is drawn in 1D, 2D or 3D space in the appropriate units (M, mm, in, etc.). The model may be created in the pre-processor, or it can be imported from another CAD drafting package via a neutral file format (IGES, STEP, ACIS, Para solid, DFX, etc.). The same units should be applied in all directions, otherwise results will be difficult to interpret, or in extreme cases the results will not show up mistakes made during the loading and restraining of the model.

.2.4 Meshing

Mesh generation is the process of dividing the analysis continuum into a number of discrete parts or finite elements. If the mesh is finer, then the results are better, but the analysis time is longer. Therefore, a compromise between accuracy & solution speed is usually made. The mesh may be created manually as well as automatically.
In the manually created mesh, the elements are smaller at the joint. Manual meshing is long & tedious process for models with any degree of geometric complication,
The mesh can be created automatically by a mesh engine; the only requirement is to define the mesh density along the model's edges. Automatic meshing has limitations as regards with mesh quality & solution accuracy.

4.2.5 Assigning the material properties

After the meshing is complete the next step is to assign desired material properties (Young's modulus, Poisson's ratio, and the density) to the created model.

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4.2.6 Applying loads and boundary conditions

Some type of loads is usually applied to the analysis model. The loading may be in the form of a point load, pressure or a displacement in a stress analysis. The loads should be applied to a point, an edge, a surface or an even a complete body. The loads should be in the same units as model geometry & material properties specified. A boundary condition may be specified to act in all directions (x, y, z), or in certain directions only. They can be placed on nodes, key points, and areas or on lines.

4.2.7 Solution

The FE solver can be logically divided into three main parts, the pre-solver, the mathematical engines, and the post solver. The pre-solver reads in the model created by the pre-processer and formulates the mathematical representation of the model. If the model is correct the solver proceeds to form the elements stiffness matrix for the problem and calls the mathematical engine which calculates the engine. The results are written to solver and the post solver is used to calculate strains, stress, etc. for each node within the component and continuum.

4.2.8 Post Processor

Here the results of the analysis are read & interpreted. They can be presented in the form of a table, a contour plot, deformed shape of the component. Contour plots are usually the most effective way of viewing results for structural type problems. Post processing include the calculation of stress & strains in any of the x, y or z directions, or indeed in a direction at an angle to the co-ordinate axes.

5. Design Calculations for Chassis Frame

Material and Geometry of Ashok Leyland (Model No.16.18) Truck Side bar of the chassis are made from "I" Channels with 228mm x 75 mm x 6 mm

Material of the chassis is ASTM A710 Steel

Front Overhang (a)	=1610 mm
Rear Overhang (c)	= 1990mm
Wheel Base (b)	= 4330mm
Modulus of Elasticity, E	= 220.5N / mm^2
Poisson Ratio	= 0.28
Capacity of Truck	=16200kg
Engine body weight	=5215kg
FOS	=3

Total load acting on chassis= Capacity of the Chassis + Weight of body and engine

= 5215+10985

=16200kg

Chassis has two beams. So load acting on each beam is half of the Total load acting on the chassis.

Load acting on the single frame = 16200/2

= 8100kg

5.1 Calculation for Reaction

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Beam is simply clamp with shock absorber and leaf spring. So, beam is considered as a simply supported beam supported at C and D with uniform distributed load.

Load acting on the entire span of the beam = 8100kg
Length of the beam = 7930 mm
Uniformly Distributed Load = 8100*9.81/ 7.930
= 10.02 N/mm

For getting the load at reaction C and D, taking the moment about C and we get the reaction load generate at the support D. Calculation of the moment are as under.

5.1.1 Moment about C

30.06*1610*1610/2= (30.06×4330×4330/2) - (Rd×4330) + (30.06*1990*5325)

R_d = 129647.808 N

R_c = 108727.992 N

5.2 Calculation of shear force and bending moment

5.2.1 Shear force calculations

Fa = 0 N

Fc = (-30.06*1610) + 108727.992

= 60331.392 N

Fd = (-30.06*5940) + 129647.808 + 60331.392

= 11422.8 N

Fb = 0 N

5.2.2 Bending moment calculations

Ma = 0 Nmm

Mc = -30.06*1610*1610/2

= -38959263 Nmm

Md = [(-30.06×5946×5946)/2] + [(60331.392*4330)]

= -269077580.6 Nmm

Mb = 0 Nmm

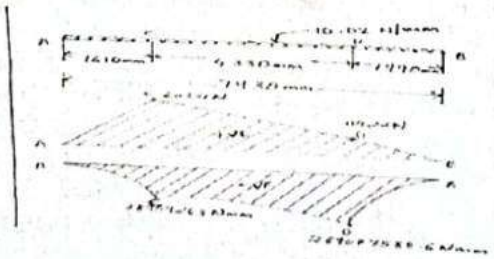

Fig 5.1: Loading diagram, SFD & BMD

5.2.3 Shear Stress Calculations

Assume angle of twist = 1°

$\Theta = 1° \times \frac{\pi}{180}$

$= 0.017452$ rad.

By considering the whole system as a one rotational body and as per following data, when in twist from its support.

Width of the chassis = 2432mm

Length of chassis = 7930mm

Distance between two reactions = 2900mm

Now basic rule for Twisting Moment is: $\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$

Shear stress, τ $= (78.125 \times 0.017452 * 2432)/7930$

$= 482.72\ N/mm^2$

Deflection of Chassis $= \frac{W*(b-X)}{24EI}[X(b\text{-}X) + b^2 - 2(c^2+a^2) - \frac{2}{b}[Xc^2 + a^2(b\text{-}X)]$

Where W= Weight of Chassis = 58860 N

a, b and c are the front overhang, wheel base and rear overhang respectively.

X = Total length/2

Deflection of Chassis = 2.66 mm.

6. Solution Methodology

The Geometric model of the chassis is developed using CATIA V5, a general-purpose modeling software

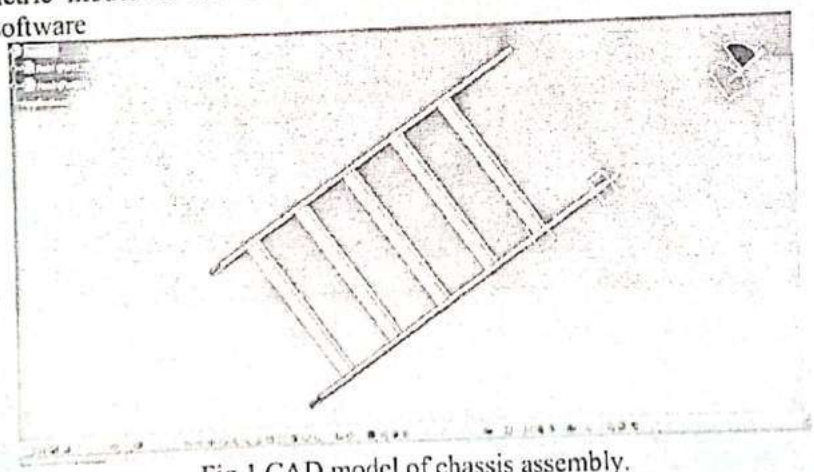

Fig.1 CAD model of chassis assembly.

Fig.1 shows the assembly of chassis CAD model. The Beams and the connecting ladder structures separately using the 'Part Design' workbench in Catia V5 and these are brought together and assembled in 'Assembly Design' workbench.

6.1 Static Structural Analysis in ANSYS

The model generated in CATIA is converted from CAT files to IGES file format in order to import the files to ANSYS which is compatible file format for input to ANSYS 14.5. This IGES file is imported to ANSYS geometry module and the model is generated without any distortion in dimensions in the model as shown in Fig 2 below.

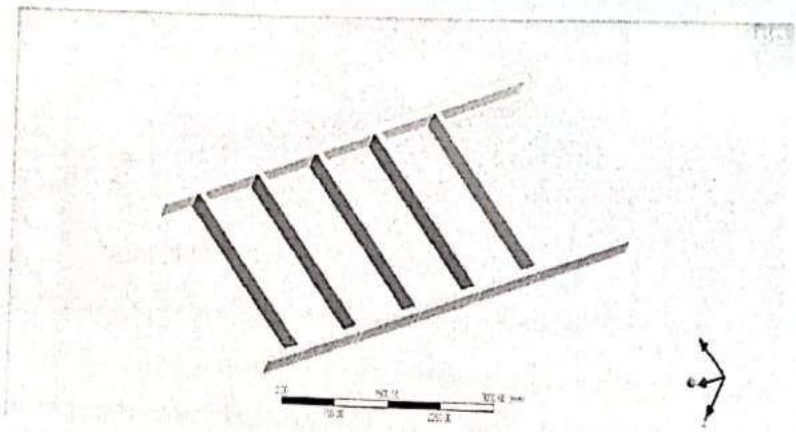

Fig 2: ANSYS Geometry Model

6.1.1 Material Property

Material properties are constitutive properties of a material such as modulus of elasticity or density of area independent of geometry. Depending on the applications, material properties may be linear, non-linear, and/or isotropic. For this analysis the Young's modulus, Poisson's ratio, yield Strength are pre-defined in the inbuilt library material function. We have preferred to select the general material in which we have selected aluminium alloy.

6.1.2. Meshing

Meshing is the procedure for applying a finite number of elements to the model. In order to conduct a finite element analysis, the structure must be first idealized into some form of mesh. The art of successful application of technique, so far as the user is concerned, lies in the combined choice of element types and associated mesh.

The auto meshing option allows the ease of meshing the volume in the simplest form by just picking the volume after defining the element type. The element type must be tetrahedron type. The software itself distributes the elements throughout the volume taking into consideration all the geometrical variations. The mesh can be refined by specifying the element size or division on edges also the refining can be done using smart size allowing to choose the element size on 1 to 10 scale.

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For obtaining the fine mesh throughout the model assembly, we have prepared an element size as 2mm. the meshed model is shown in Fig 3.

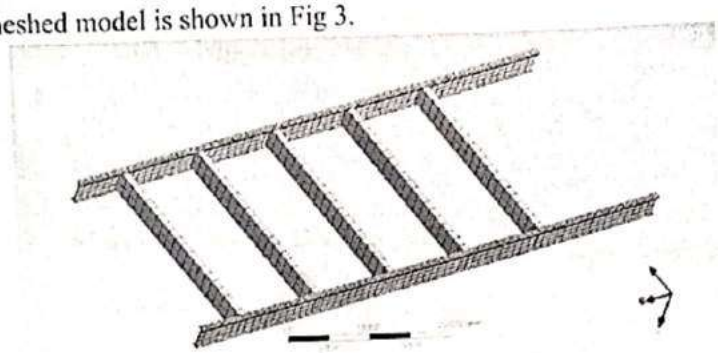

Fig 3: Meshed Model of Ladder type Chassis.

6.1.3 Boundary conditions

The constraints are applied according to the actual conditions that exist. The outer surface of the corners of beams are fixed as shown in Fig 4

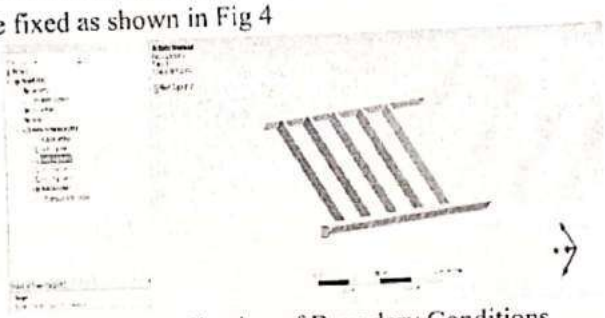

Fig 4: Application of Boundary Conditions

6.1.4 Application of load

The main goal of FEA is to examine how a structure or a component responds to a loading condition. Specifying the proper loading condition is, therefore, a key step in analysis. We have applied the load on the upper surface of the chassis. In the below figure, red area shows the load acting.

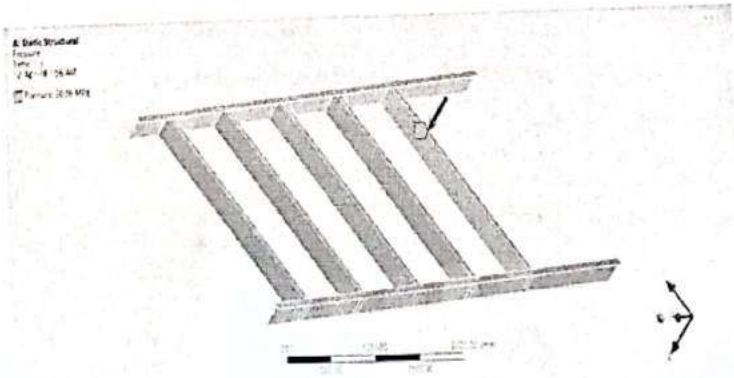

Fig 5: Applications of Loads

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7. Results & Discussion

The Geometry of the vehicle chassis is modeled by CATIA V5. The details of the model are mentioned in point 5. The finite element model and analysis are carried out using ANYSYS V14.5. The results of the analysis are presented in this chapter.

7.1 Stress

The below figures show the distribution of Von Mises stress over the entire chassis. It is found that higher intensity of stress is induced on the edges of the beams.

Materials	Maximum Stress (Mpa)	Minimum Stress(Mpa)
Structured Steel	1.9225e5	15.026
Aluminum Alloy	1.9181e5	15.026
Grey Cast Iron	1.9249e5	14.976

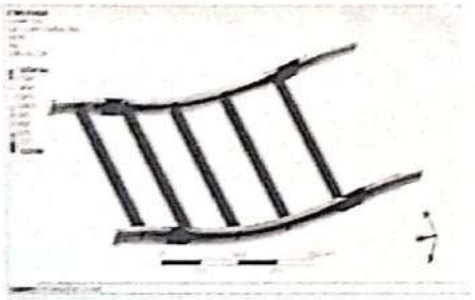

Fig 6: Stress for structural steel

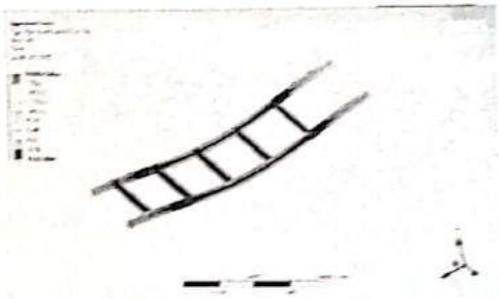

Fig 7: Stress for Aluminum alloy

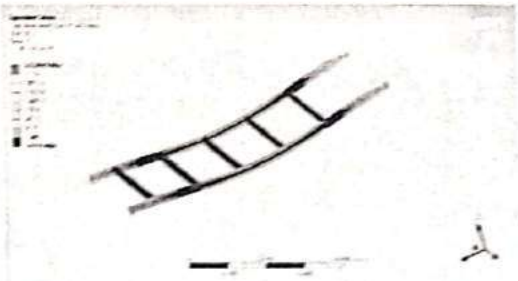

Fig 8: Stress for grey cast iron

7.2 Strain

The below figures show the distribution of Equivalent Elastic strain over the entire chassis. It is found that higher intensity of strain is induced on the edges of the beams.

Materials	Maximum Strain	Minimum Strain
Structured Steel	0.96127	0.10699
Aluminum Alloy	1.7499	0.00015489
Grey Cast Iron	2.7016	0.00026156

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Fig 9: Strain For structural steel

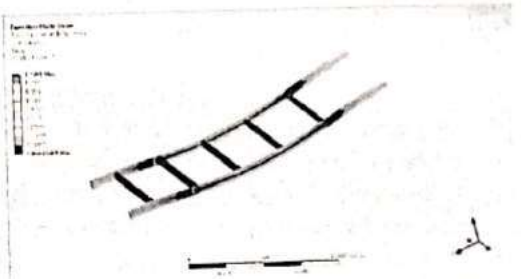

Fig 10: Strain for aluminium alloy

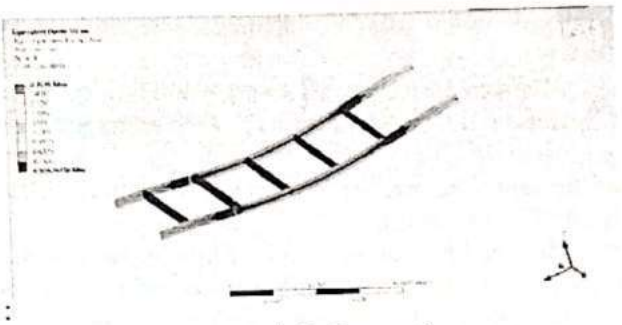

Fig 11: Strain for Grey cast iron

7.3 Deformation

The maximum deflection on the chassis applying different Materials is found to be as follows:

For structural steel- 15910 Max

For aluminum alloy- 44821 Max

For Gray Cast Iron- 28924 Max

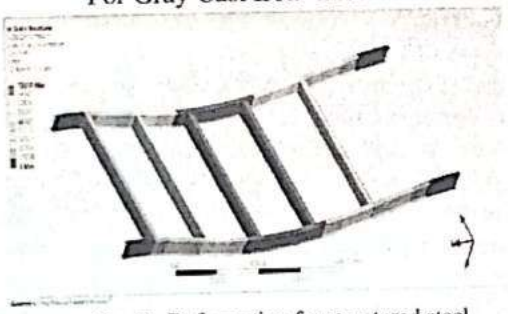

Fig 12: Deformation for structured steel

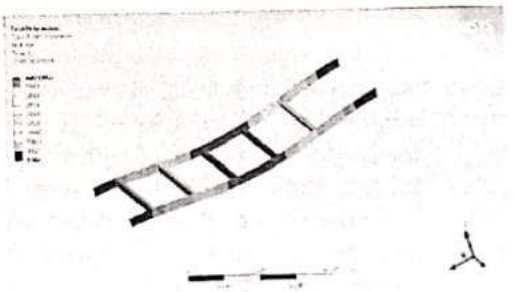

Fig 13: Deformation for Aluminium Alloy

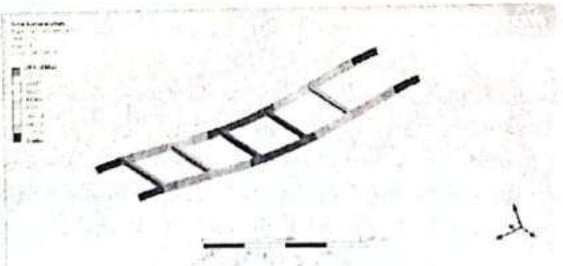

Fig 7.9: Deformation for Grey Cast Iron

8. Conclusion and Scope for Future Work

The work started with selection of truck (ASHOK LEYLAND1618), and calculating the stresses induced on chassis by taking the data from the selected truck manual. Later designing procedure was started and "I" cross selection was selected. After the dimensions were found, the CAD model is generated using those dimensions in CATIA v5. Later the CAD model is imported to ANSYS 14.5 for analysis procedure. A systematic analysis is carried out by meshing the model and then by applying proper constraints. Calculated loads are then applied and several runs are conducted. Finally, the design was analyzed for different materials and comparison was done to know which material was holding good characteristics for "I" cross section.

a. Deformation in the aluminum alloy is maximum compared with cast iron and structural steel.

b. Gray cast iron is not selected because of its weight and brittleness.

c. Aluminum is lighter in weight compared to other materials but, the deflection here is maximum.

d. Considering all the above factors, Steel has better strength and characteristics as compared to other materials for "I" cross section.

This work may be extended by attempting other methods such as changing the cross-section and different dimensions. Also, the work can be extended by introducing comparative study of different types of composite materials used for manufacturing.

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Prediction of Reliability Parameters and Reliability of Electric Discharge Machining by Probability Plotting

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ABSTRACT:

In electric discharge machining (EDM), predicting the reliability of electrode and tool is most important to arrive with the optimum process parameters. In this paper, the material removal rate, tool wear ratio and electrode wear rate of EDM process are plotted with weibull distribution. The shape and scale parameters of these plots are used to forecast the reliability of tool and electrode. The method of probability plotting is used for calculating the parameters of the weibull distribution. With the value of β and η, the reliability of tool and electrode is predicted at different time period. This process requires very less time, easy calculations and minimum data of MRR, TWR & EWR to find the reliability of EDM parameters. Since weibull is generalized form of distributions, it can also be applicable to find the reliability at any other kind of failure rates.

Keywords: - Weibull distribution, MRR, EDM, Reliability, probability plotting

INTRODUCTION:

With the increasing demand for new, hard, high strength, hardness, toughness, and temperature resistant material in engineering, the development and application of EDM has become increasingly important.[1] EDM has been used effectively in machining hard, high strength, and temperature resistance materials [2]. Material is removed by means of rapid and repetitive spark discharges across the gap between electrode and work piece. Since the EDM process does not involve mechanical energy, the removal rate is not affected by hardness, strength or toughness of the work piece material [3].Therefore, a comprehensive study of the effects of EDM parameters (peak current, machining voltage, pulse duration and interval time) on the machining characteristics such as electrode wear rate, material removal rate, surface roughness and etc., is of great significance and could be of necessity. The weibull distribution method which is a powerful tool for parametric design of performance characteristics is used to determine the optimal machining parameters for minimum electrode wear ratio, maximum material removal rate and minimum surface roughness in the EDM operations. [4]

The weibull distribution is a general-purpose reliability distribution used to model material strength, failure data of electronic and mechanical components, equipment or systems. Weibull distribution is a versatile distribution that can take on the characteristics of other types of distributions, based on the value of the shape parameter, β &scale parameter η. *[5]*

Probability plotting was originally a method of graphically estimating distribution parameter values. With the use of available failure data parametric values are calculated, the probability plot now serves as a graphical method of assessing the goodness of fit of the data to a chosen distribution. Probability plots have nonlinear scales that will essentially linearize the distribution function, and allow for assessment of whether the data set is a good fit for that particular distribution based on how close the data points come to following the straight line. The y-axis usually shows the unreliability or probability of failure, while the x-axis shows the time or ages of the units. Specific characteristics of the probability plot will change based on the type of distribution.

PROBABILITY PARAMETERS:

Distributions can have any number of parameters. The amount of data required for a proper fit increases with the number of parameters. In general, most distributions used for reliability and life

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data analysis, the lifetime distributions, usually are limited to a maximum of three parameters. These three parameters are usually known as the scale parameter (η), the shape parameter (β) and the location parameter (γ). Here, in this case, two parameters Weibull distribution is used, parameters being the scale & the shape.

1. Scale Parameter (η):

The scale parameter is the most common type of parameter. All distributions in this reference have a scale parameter. In the case of one-parameter distributions, the sole parameter is the scale parameter. The scale parameter defines where the bulk of the distribution lies, or how stretched out the distribution is. In the case of the normal distribution, the scale parameter is the standard deviation.

2. Shape Parameter (β):

The shape parameter, as the name implies, helps define the shape of a distribution. Some distributions, such as the exponential or normal, do not have a shape parameter since they have a predefined shape that does not change. In the case of the normal distribution, the shape is always the familiar bell shape. The effect of the shape parameter on a distribution is reflected in the shapes of the Probability Distribution Function (PDF), the reliability function and the failure rate function.

PROBABILITY PLOTTING:

The values of unreliability plotted on y-axis are calculated using Bernard median rank estimator formula which is given by

$$F(t_i) = \frac{i - 0.3}{n + 0.4}$$

where i is the failure order number and N is the total sample size.

The values of MRR, TWR & EWR are plotted on x-axis which is given as failure data.

Because Weibull distribution is used, it's cumulative density function (cdf) is considered. The cdf for Weibull distribution is given by

$$F(T) = 1 - e^{-(\frac{t}{\eta})^{\beta}}$$

So at T= η

$$F(T) = 1 - e^{-(\frac{\eta}{\eta})^{\beta}}$$
$$= 1 - e^{(-1)^{\beta}}$$
$$= 0.632$$
$$= 63.2\%$$

The value of T= η for the corresponding unreliability value of 63.2%

I. EFFECT OF MATERIAL REMOVAL RATE ON RELIABILITY:

The failure data collected is

(i)	1	2	3	4	5	6	7	8	9	10	11
MRR (mg/min)	8.312	16.302	23.672	28.036	32.549	35.678	38.321	43.256	45.213	47.564	52.369

The Graph plots obtained for MRR of EDM from Weibull++ V7

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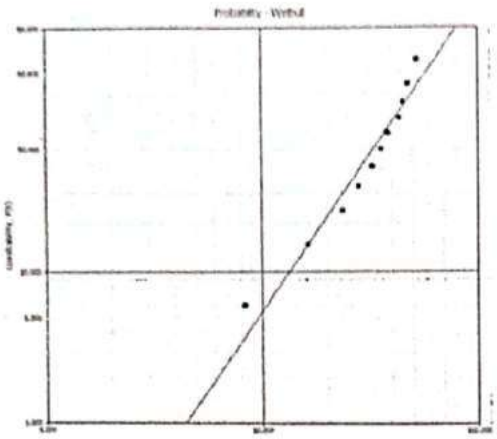

Fig 1-Unreliability vs MRR

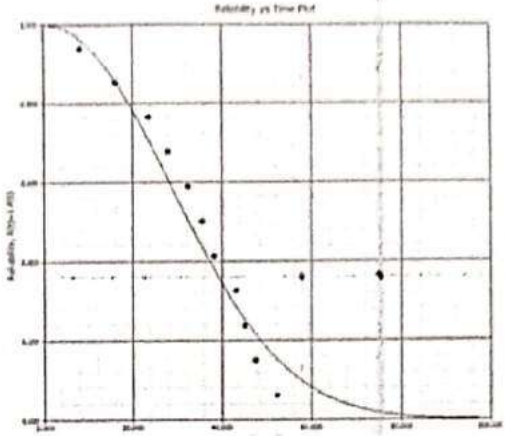

Fig 2- Reliabilty plot

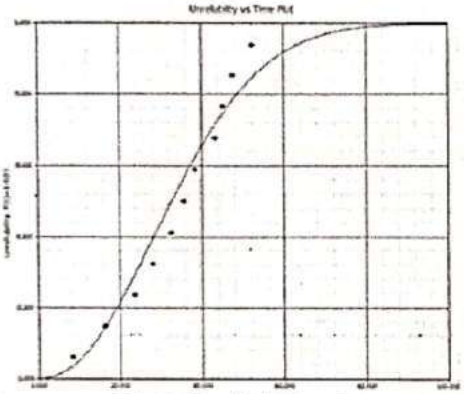

Fig 3- Unreliability plot

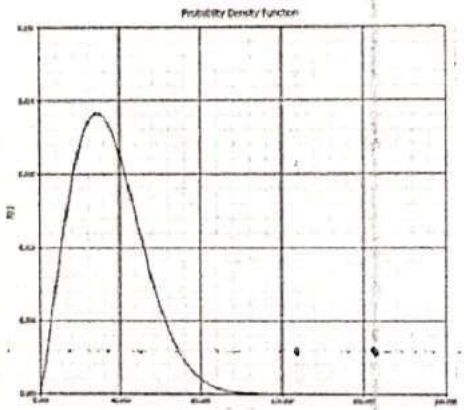

Fig 4 - pdf plot

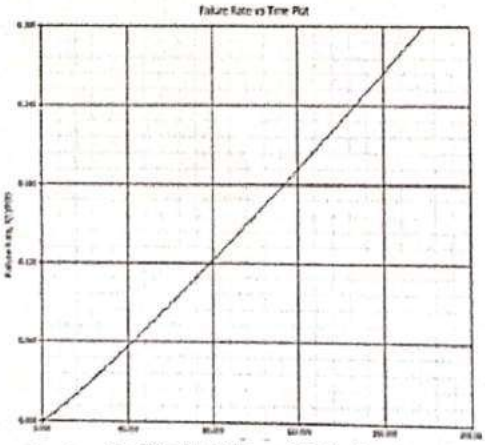

Fig 5- Failure plot

The Weibull parameters β & η are obtained from graph are 2.1160 & 38.8368 respectively. So the reliability of tool is calculated for t (i.e.at for any MRR)= 25 mg/min is given by

$$R(T) = e^{-(\frac{t}{\eta})^{\beta}}$$

$$R(T) = e^{-(\frac{25}{38.8368})^{2.1160}}$$

$$= 0.6745$$

$$= 67.45\%$$

II. EFFECT OF TOOLWEAR RATE ON RELIABILITY:

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The failure data collected is

(i)	1	2	3	4	5	6	7	8	9	10	11
TWR (mg/min)	1.302	2.565	5.523	6.678	7.712	12.864	16.349	19.838	28.984	33.382	46.230

The Graph plots obtained for TWR of EDM from Weibull++ V7

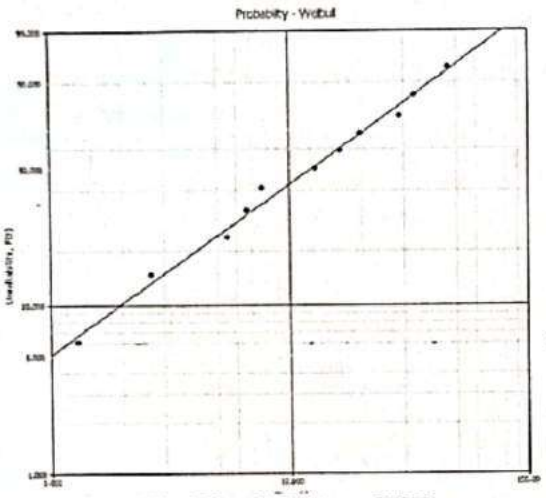

Fig 6-Unreliability vs TWR

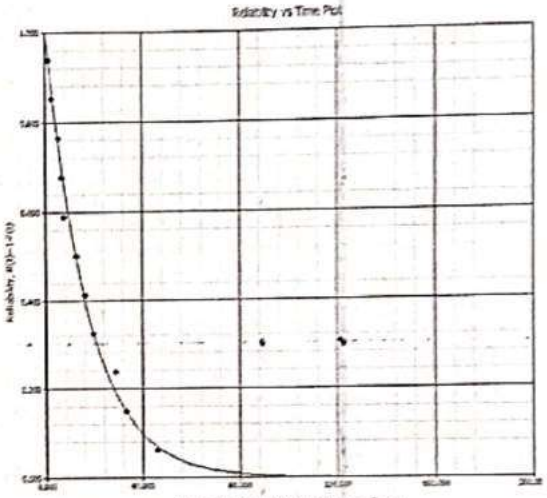

Fig 7- Reliabilty plot

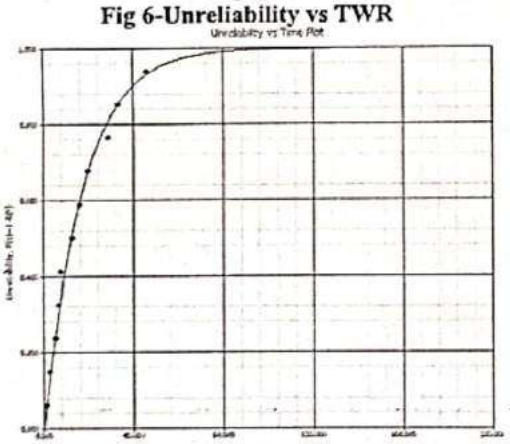

Fig 8- Unreliability plot

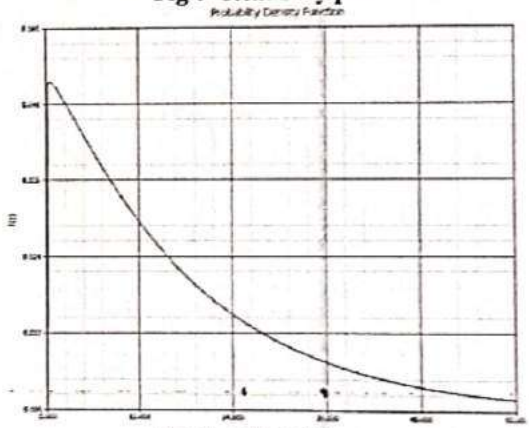

Fig 9 - pdf plot

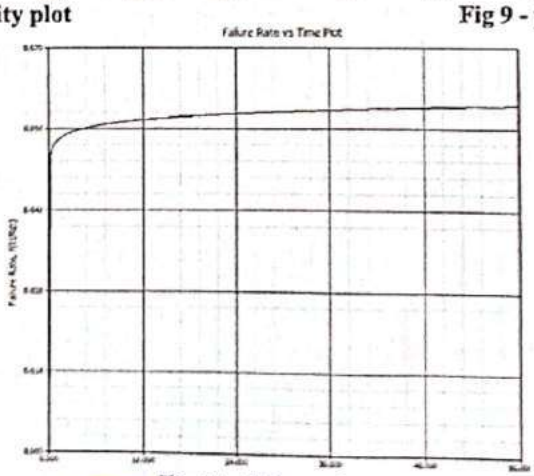

Fig 10- Failure plot

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The Weibull parameters β & η are obtained from graph are 0.9755 & 18.9341 respectively, so the reliability of tool is calculated for t (i.e. for any TWR)= 25 mg/min is given by

$$R(T) = e^{-(\frac{t}{\eta})^{\beta}}$$

$$R(T) = e^{-(\frac{25}{18.9341})^{0.97550}}$$
$$= 0.2695$$
$$= 26.95\ \%$$

III. EFFECT OF ELECTRODE WEAR RATIO ON RELIABILITY:

The failure data collected is

(i)	1	2	3	4	5	6	7	8	9	10	11
EWR (mg/min)	3.76	5.47	9.98	10.61	11.18	12.76	13.69	14.41	17.86	19.12	35.61

The Graph plots obtained for EWR of EDM from Weibull++ V7

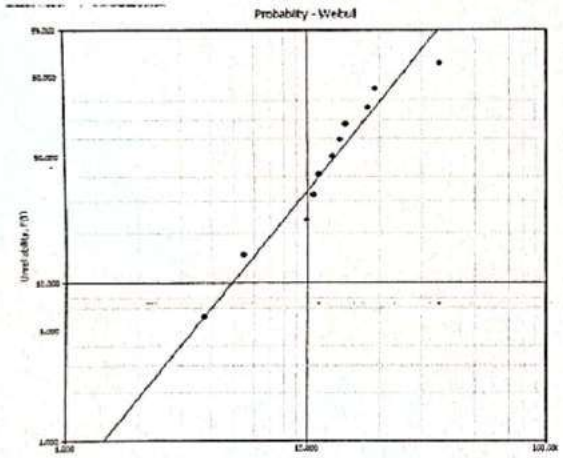

Fig 11-Unreliability vs EWR

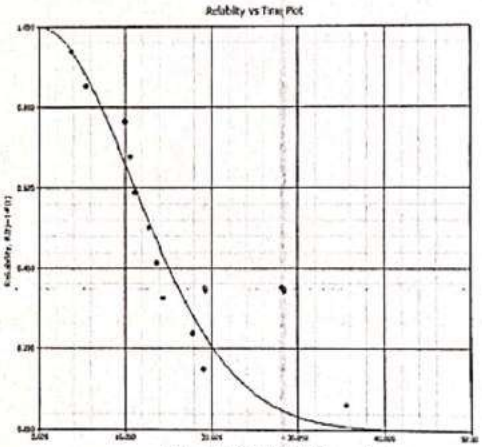

Fig 12- Reliabilty plot

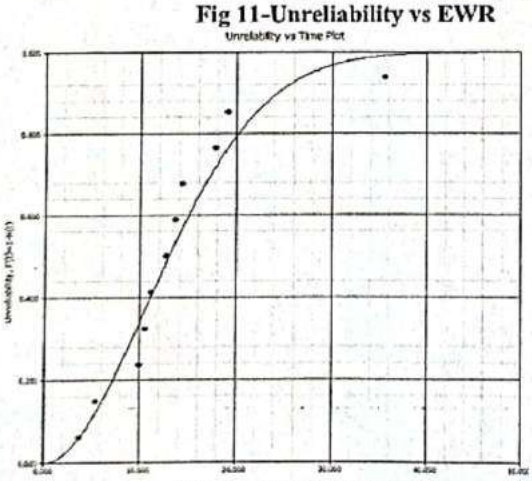

Fig 13- Unreliability plot

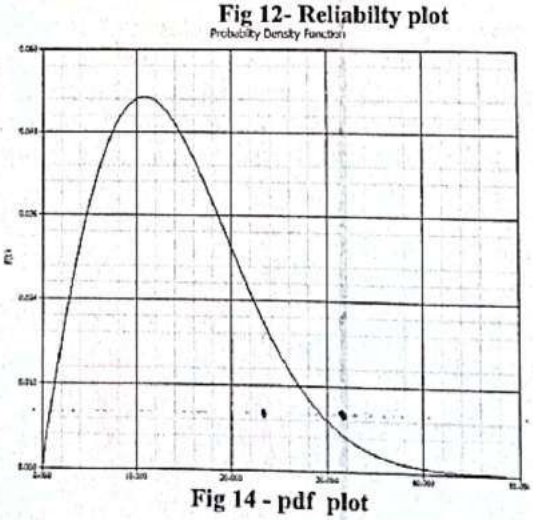

Fig 14 - pdf plot

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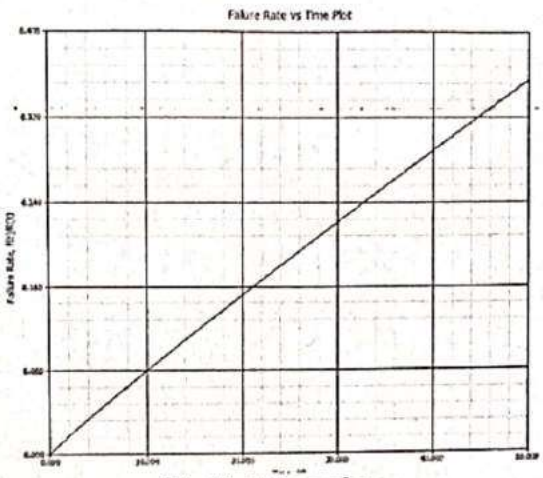

Fig 15- Failure plot

The Weibull parameters β & η are obtained from graph are 1.9264 & 15.7853 respectively, so the reliability of electrode is calculated for t= 25 is given by

$$R(T) = e^{-(\frac{t}{\eta})^{\beta}}$$

$$R(T) = e^{-(\frac{25}{15.7853})^{1.9264}}$$
$$= 0.088495$$
$$= 08.8495\%$$

Conclusion: -

From the above plots it is concluded that the reliability of tool can be calculated at any given instant with minimum failure data.

With the use of weibull distribution in probability plotting reliability parameter are calculated easily and reliability is obtained using these parameters.

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