JAIN UNIVERSITY

Declared as Deemed-to-be University u/s 3 of the UGC Act, 1956

The Department of
MIND MANAGEMENT AND HUMAN VALUES
Under the aegis of
HUMAN NETWORKING ACADEMY
(A Division of Jain Group of Institution)

Offers an experiential course to all the first-year students of

Under-Graduate Program –

MIND MANAGEMENT & HUMAN VALUES

(VISHVA – CHAITANYA)

MESSAGE

Dear Faculty & Students,

It is heartening to know that the **Human Networking Academy**, a distinguished division of **the Jain Group of Institutions** (**JGI**), has prepared a Mind Management and Human Values course and suitable course materials to be included in the Jain University undergraduate programmes. I congratulate the members of HNA for their invaluable experience, meticulous planning and tremendous energy for such a course, a reality in a very short time.

In these days of globalisation, it is challenging to convince students of the need for and the importance of keeping their minds serene, unpolluted and open to enable them to realise the full potential of their mental faculties.

Intending to equip the students with the requisite knowledge and skills to strengthen their minds, **Jain University** has introduced a course entitled **Mind Management and Human Values** in its undergraduate course curriculum.

I am happy to express my appreciation for Prof. K.S. Shantamani, Chief Mentor of JGI, for her commitment and dedication in planning the course and taking all the trouble to inculcate human, spiritual and ethical values in our students.

Prof. N. Sundararajan

Pro - Chancellor
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INTRODUCTION

Chaitanya means consciousness – The source of our life. Our mind is a limited force, also called Vyashti-Chaitanya (व्यष्टि-चैतन्य). Prayer and meditation connect us to the **Universal Mind** or **Vishva-Chaitanya**, the power directing and sustaining all the laws and movements of the universe. This linking of the Individual Mind with the Universal Mind is known as **YOGA**, best symbolised by Namaskāra-Mudra.

Yoga is a comprehensive term that covers different aspects of personality development. A few elements that can be enlisted are being aware of our thoughts, further differentiating between positive and negative thoughts, and finally, retaining positive thoughts and practising a positive lifestyle. Additionally, it helps us to fine-tune the body-mind complex. Yoga also enhances our concentration and memory. In the Bhagavadgītā, several kinds of Yogas are mentioned. They are all practical paths that lead us to the fulfilment of life by delving deep into the ultimate source of energy and bliss.

"Growth and inner evolution" and "Raise yourself by self-effort" – are the empowering watchwords of the Jain Group of Institutions. Our sources of guidance and inspiration are the wisdom of the Upanishads, the life histories of ancient and modern sages, the techniques of yoga, and the insights of modern humanistic psychology**.**

Dr Chenraj Raichand,
Chairman, Jain University

BIAS

One goes through life between birth and death unpredictably. However, there is predictability and certainty behind the unpredictability, which one constantly chooses by putting in the necessary efforts. Though this predictability and certainty factor gives a sense of security, it can easily make one mechanical and robotic instead of robust. For instance, one can take many risks, thereby building one's own company and employing a thousand others; thus, live a happy life and help a thousand others lead a happier life. On the contrary, people are happiest to find a job with minimalistic risk, which fetches them a consistent income that can sustain their life predictably and smoothly. This example of one being an employer or ending up as an employee, doesn't speak about a person's true intention and behaviour. This example is neither a parameter to assess an individual's value system nor a parameter to brand them in any way. This example only shows the path most take up for convenience and many such factors.

What is notable in this example is the fact that a man, in the process of finding certainty, is trapping himself within such boundaries that limit his thinking and abilities. An employee will always have lesser abilities and skill sets, leading to lesser experiences, compared to the one who employs and bears more risks in life. It's one's choice that makes or mars them.

Let's quickly see what factor allows an individual to express himself optimally if one seeks more predictability and certainty, using the following example:

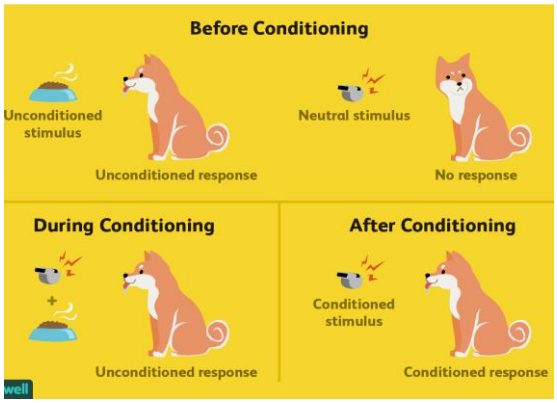
If a man needs a break from office work on a weekend and is not ready to extend himself beyond Friday, he should choose a job that binds him between Monday and Friday. If one must ask a more significant question in this context, doesn't Saturday and Sunday also give him experiences? An individual who has chosen to work all through life would see more pleasure and true rejuvenation-cum-break in the task undertaken than a predictable weekend break. All said and done, seeking a weekend break is again not a question of good versus evil. Instead, it is all about how one sees life as limitless or limited in terms of one's profession. The moment one seeks to

grow only between 5 days of the week will set such a pattern that will make life mechanical, repetitive, and robotic. As much as it gives a sense of security, this mechanical, repetitive, and robotic life also causes unavoidable damage to the human brain. It makes the brain accustomed to pattern-based learning, which has advantages. However, the disadvantages outweigh any such gained advantages.

An adolescent had gotten used to having ice cream whenever he went to a restaurant or was invited to a treat/party. He got so used to it that, a few days before the exams, he ate ice cream mindlessly at a birthday party, further aggravating his cold and throat infection, leading him to miss an exam. Becoming repetitive is sometimes becoming mindless! But repetition done mindfully is elevating and called a perfect practice.

Mindless repetition can also be vaguely called conditioning of the mind. Nobel Laureate Ivan Pavlov, a Russian Physiologist, was deeply interested in understanding human behaviour and thus developed a Classical Conditioning theory. Classical Conditioning is an unconscious or automatic learning. This learning process creates a conditioned response through associations between an unconditioned stimulus and a neutral stimulus.

Classical conditioning involves placing a neutral stimulus before a naturally occurring reflex. In Pavlov's classic experiment with dogs, the neutral signal was the sound of a bell, and the naturally occurring reflex was salivating in response to food. By associating the neutral stimulus (sound) with the unconditioned stimulus (food), the sound of the bell alone could produce a salivation response.



An **unconditioned stimulus** is a stimulus or trigger that leads to an automatic response. For instance, if a cold breeze makes you shiver, the cold breeze is an unconditioned stimulus.

A **neutral stimulus** is a stimulus that doesn't initially trigger a response. If you see a beach ball in the sand, for example, it wouldn't necessarily trigger a response. That would make it a neutral stimulus.

A **conditioned stimulus** is a once neutral stimulus (didn't trigger a response) but now leads to a response. If you used never to pay attention to a passing dog until you got bit by one, now causing you to feel fear every time you see a dog, the dog has become a conditioned stimulus.

An **unconditioned response** is an automatic response or a response that occurs without thought when an unconditioned stimulus is present. If you smell your favourite food and your mouth starts watering, mouthwatering is an unconditioned response.

A **conditioned response** is a learned response or a response that is created where no response existed before. Going back to the example of being bitten by a passing dog, now causing you to feel fear whenever you see one, the fear you've started to experience is a conditioned response.

The experimenter first presented the dogs with the sound of a bell; they did not salivate; this was a neutral stimulus. He then presented the dogs with food, and they salivated. The food was an unconditioned stimulus, and salivation was an unconditioned (innate) response. He then repeatedly presented the dogs with the sound of the bell and the food subsequently. After a few repetitions, the dogs salivated when they heard the bell. The bell had become the conditioned stimulus, and salivation had become the conditioned response.

This conditioned response over a period turns into our choice or preference. These preferences or choices will even start influencing our judgement, and eventually, we get trapped in a bias.

For instance, if we are to make a list of things which are termed as breakfast, we end up writing a menu like this – Puri, Dosa, Idly, Poha, Upma, Omelette, different kinds of rice items depending on the Indian state we come from, and so on. With such a conditioned mind, if we go to a place in Europe or America wherein a breakfast can be a waffle, pancake, and a glass of juice with a bland pizza, we might find it extremely difficult to consume them. A new breakfast may be exciting once or twice during a short trip, but eating the same breakfast as a routine would be challenging. Why? Our mind has accepted certain dishes of the Indian subcontinent as breakfast, and to rewire the brain and believe that something else will be the breakfast is a process which takes a lot of time and effort.

These are examples of conditioning and how, over a period, it leads to certain specific choices and preferences that form a deep-rooted impression that affects all our major decisions in life. **Bias** is a mental block; in the worst case, it's a psychological disease. Some biases are dangerous, whereas some may be harmless.

The general belief that women are more compassionate has made almost all nursing colleges replete with young girls and not boys. Similarly, the general belief that women are not physically strong has made civil engineering and mechanical engineering classrooms dominated by boys, as they can stand on construction sites for long hours and lift heavy tools. Such biases are examples of gender biases. Some biases are known to us. Instead, we are aware of them, and some are unknown to us; instead, we are unaware of them, yet they exist within us! These two phenomena are called **Conscious and Unconscious bias**, respectively.

But a few biases can ruin our careers, familial value systems and even a nation. Let's see a few of them today.

SURVIVORSHIP BIAS

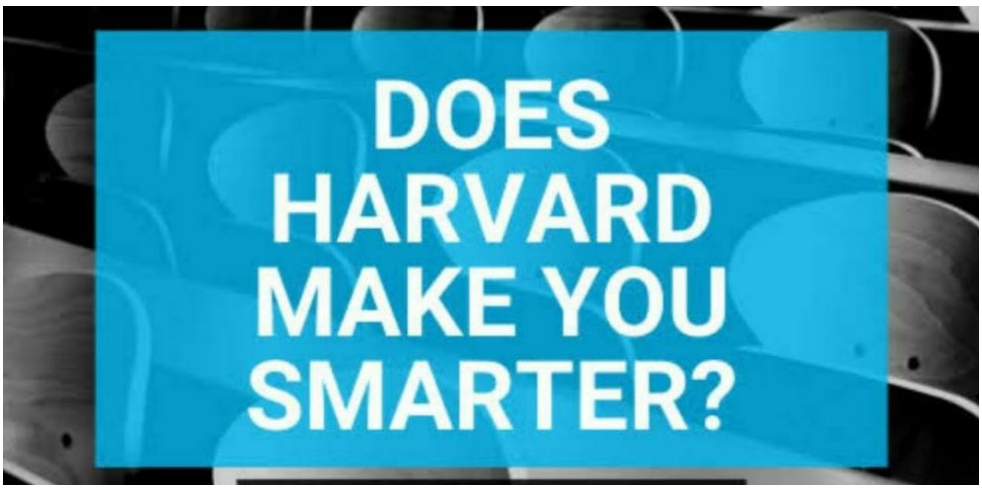
In daily life, success is more frequently spoken about than failure. There is more visibility of success and less of failure. Hence, we assume we will succeed tremendously in every domain. This exaggerated sense of our self-esteem and self-worth has led to significant damage for more than a few thousand years. All start their life on the notes of great ambition backed up by flowery imaginations and rosy words, while only a few achieve things

that are the bare minimum to even a common-sensical existence. This massive gap between what we think, what we speak and how we act is a terrible result of a horrifying bias called **survivorship bias**. Everyone inspires us to follow our passion, but no one tells us how to achieve the same systematically. Hence, we use big words like the way it is seen in the image below –

It is good to be optimistic. In a state of optimism, we are prepared and execute our plans well. In survivorship bias, there is more imagination from half-baked data and significant conclusions based on significantly fewer facts and research. Primarily baseless, this dry imagination can do more damage and less good in the long run.

MODEL'S COSMETIC BIAS

Looking at models in cosmetic advertisements, consumers believe they will become beautiful and handsome if they use the same. In actuality, the models were born with specific appealing characteristics, and that's the reason they are chosen for cosmetic advertising and not the other way around! The statement below gives us a better view of this bias – Does Harvard make you smarter, or do intelligent people go to Harvard?



SOCIAL CONFORMITY BIAS

Imagine you are on the way to a concert, and you see some people in a corner standing and staring at the sky; in most cases, we join the crowd. Once in the concert, if people start clapping at the fantastic display of the performer's mastery of his art and skills, we also begin clapping. In the end, if we all start leaving a tip in a box for the magic the concert created, we also put in a little money, though the money we offer as a token of respect or love is part of the amount we paid for the ticket. Social conformity or social proof bias is a kind of herd behaviour. We are accepted if we behave the same way society does. The more people display a specific behaviour, the more appropriate it is for others to judge it.

If one observes the above image, we understand how society, through celebrities, influencers, advertisers, models, etc., has been influencing our

lives knowingly or unknowingly. Today, what we call independent thinking is truly a reflection of which ideology we choose to have. Thus, there is no independence as such. None of us are independent enough to ignore societal norms and live creatively yet harmlessly. We all want to be accepted by others and want people around us to validate our lives and lifestyles, causing an erosion of our true hidden identity, and losing the idea of who we indeed are. The more we appease others, the more we lose ourselves and become a fragment of others' imagination. By being good in others' imagination, we eventually achieve very little, thus making life less satisfactory.

UNIVERSAL MESSAGE OF THE BHAGAVAD GITA

The Bhagavadgita is a text that conveys to humanity the need for a balanced lifestyle and a poised outlook. Bhagavadgita is part of Mahabharatha, and it has 18 chapters. The third is essential as it conveys to humanity the greatest of virtues.

The third chapter – **'KARMA-YOGA'**, speaks of the need to work, and to perform every action with the right attitude. A man plagued by fear and insecurity has become inefficient or has redefined his perspective towards any work as a source of some seen or unseen profit. He has no permanent friends or enemies but only has a few people for profit. As a result, society is predominantly filled with selfish people.

Karma means Work; **Yoga** means Union; **Karma Yoga** means a deeper involvement with whatever work you do. By changing our perspectives and attitudes towards work, we can make every work nobler and execute it more efficiently. People with such a Selfless attitude and outlook for work are called **Karma-Yogis**.

Through its third chapter, Karma yoga teaches two essential ideas: '**Paraspara Bhāvanā'** and **'Loka Saṅgraha'**.

- **'Paraspara Bhāvanā'** – Mutuality and interdependence are the way to progress, not by isolation, confrontation, or exploitation.

We violate nature, and we become violated by nature. Similarly, we work symbiotically with Nature and human beings, reaping the benefits of cooperative living.

- **‘Loka Saṅgraha’** – Welfare of the people.
  An individual's true growth automatically results in society's larger welfare.

CREATIVITY

The concept of creativity has gained importance in recent years. For example, a vast amount of management literature has increasingly focused on enhancing workplace creativity to cope with constantly changing environments. Creative thinking is the ability to let your mind create often different and unusual thoughts. Creative thinking revolves around the idea of thinking beyond the scope of the norm. It is all about thinking outside the box and being original in your thought process. Creative thinking is something you can train your mind to do. Some people are born with creative thinking abilities, while others have to work to let themselves be creative thinkers. However, anyone can become a great creative thinker whether they were naturally born or they have to work at it. You hold the key to adopting creative thinking; by doing so, you could change your life, thoughts and world forever.

What is Creative Thinking?

Thinking, in general, is a process. It is natural. We all do it, and it usually is not something we spend much time perfecting. However, in some cases, the ability to be a creative thinker is essential. Creative thinking is all about coming up with ideas and thoughts that the average person would not come up with. Creative thinking can be defined as thinking outside the box, which means thinking beyond the normal scope.

Definitions –

Sternberg and Lubart maintain that "Creativity is the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful concerning tasks constraints)". Runco presents several authors who define creativity as creating something new and valuable.

A creative solution has Three Attributes:

1. It is **new/novel** (otherwise, it would not be creative).
2. It is **useful** because it solves the problem (otherwise, it would not be a solution).
3. It is **feasible**, given the messy real-world constraints like money and time.

Benefits of Creative Thinking

Creative thinking can make a person a perfect problem solver. Thinking creatively allows one to devise solutions to problems others may never even consider. A person can come up with good ideas that may not be so obvious. Creative thinking can significantly benefit almost any profession because quick thinking is a great skill.

Creative thinking can give a person a completely new outlook. They will be able to use it in their professional and personal life. They will start implementing creative thinking techniques no matter what they are doing because it will come naturally. Creative thinking can change a person's whole attitude. It will make them more confident and allow them to live up to their full potential because they will not doubt their abilities. It can be a morale booster and enable someone to show what they can do.

Above all, creative thinking can be a ticket to success and great accomplishment. A creative thinker is challenging to hold back. They are always thinking and always on top of their game. It is hard to deny a creative thinker anything because they are good at what they do. They can bring their creative thinking to the table to help improve their life and accomplish their goals. Creative thinking has some fantastic benefits. It is hard to deny that creative thinking can benefit a person. It is easy to start being a creative thinker and make it change your life.

When To Use Creativity?

While tackling old problems, during free time after difficulties, when the pay-off of new ideas is significant, Routine re-examination of assumptions, generating alternative decisions, inferring new utility of data, inferring new utility of data, to find new opportunities, and dissolving artificial problems when logical thinking fails.

Creative thinking process:

- **Step 1: Preparation -** You begin by looking over the situation. It would be best if you took everything you could about the situation. Get details and ask questions. You must get to know the problem at this point. Analysis involves finding the situations, who, what, where, when, and how. Once analysis is complete, you should be able to thoroughly explain the situation, including any apparent problems or issues.
- **Step 2: Incubation -** This is a valid area of creative thinking. Once you know about the situation, you can begin to start thinking. You can brainstorm in any manner that works for you. You may shout out ideas or write them down. Whatever works for you is best to do. Brainstorming can take on many forms. You can write things down, talk things out or even conduct experiments. Brainstorming should be free-flowing and recorded so that no good ideas are lost.
- **Step 3: Illumination -** Now that you have a nice collection of ideas, you can start going through them and weeding out ones that will not work. You may find that if you change an idea just a little, it will work much better. This step is all about tweaking your ideas. You will review your thoughts and weed out those that won't work. It would be best if you ended up with the ideas that seem to be the best solutions.
- **Step 4: Verification -** The final step involves getting your final idea. This will help you to come up with one or two ideas that seem to stand out and be the best. You will review your left ideas and narrow them to one or two plausible ones. You should then be able to go into detail about how each idea will work and how it will be implemented.

ROAD BLOCKS to Creativity –

1. **Internal Factors** that threaten your creativity include psychological and mental attributes, such as the degree to which you are open-minded or self-confident. A positive outlook and a healthy sense of well-being motivate me to be more creative and dare to open to new experiences. Most individuals find that they have much more control over the internal factors than over the external ones. If you take the

time to understand and master the issues that create internal conflict, you can see a tremendous change in your creativity.

2. **Fear of Failure** – From childhood, people learn that success is rewarded and failure is punished. This implicit message can be very debilitating, as many adults develop an exaggerated fear of failure. For some, the fear of failure can serve as a mobilising force, urging them to succeed. More often, however, this fear makes them avoid taking risks and shy away from competitive situations. This often paralysing force keeps us from working to our potential. The more creative you are, the more you will periodically re-evaluate the worth of all existing practices. And the more you improve existing operations, the more creative you will feel. Creativity begets creativity.
3. **Emotional Blocks** – "Thinking is emotional." When we face a difficult situation, our great reaction often comes from an emotional response. As with fear of failure, specific emotional responses can keep us from realising our full creative potential.
4. **Rigidity** – Rigid people take a formulaic approach to life and fail to adapt, even though "exceptions to the rule" constantly present themselves. It is a functional fixedness whereby you fail to see alternative uses for things beyond those uses for which they were initially intended. A passionate set of pre-conceived beliefs often unwanted by actual information shuts more doors than it opens.

Creative thinking is a gift, a skill. Give it a try and see how far it can take you. You will never know unless you try. So, put creative thinking to work in your life starting today. Have a little fun training your mind to think creatively.

Blockbusters to Creativity -

1. Separate IDEA generation from evaluation
2. Test Assumptions
3. Avoid Patterned thinking
4. Create new perspectives

5. Minimize negative thinking
6. Take prudent risks

Tools for Enhancing Creativity

1. **Brainstorming – by Alex Osbourne –** Brainstorming is a valuable and popular tool that you can use to develop highly creative solutions to a problem. It is constructive when you must break out of stale, established thinking patterns to create new ways of looking at things. This can be when you need to develop new opportunities, where you want to improve the service you offer, or when existing approaches aren't giving you the desired results. Used with your team, it helps you bring the experience of all team members into play during problem-solving. This increases the richness of solutions explored (meaning you can find better solutions to your problems and make better decisions.) It can also help you get buy-in from team members for the chosen solution - after all, they have helped create it.
2. **Mind Maps – by Tony Buzan –** Mind maps are superior note-taking methods because they do not lead to a "semi-hypnotic trance" state induced by other note forms. Buzan also argues that the mind map utilises the full range of left and right human cortical skills, balances the brain, and taps into the alleged 99% of your unused mental potential and intuition (which he calls "super logic"). A mind map is often created around a single word or text, placed in the centre, to which associated ideas, words and concepts are added. Mind maps can be used for –
    a. Problem Solving
    b. Outline / Framework Design
    c. Anonymous collaborations
    d. Marriage of words and visuals
    e. Individual expression of creativity
    f. Condensing material into a concise and memorable format
    g. Team building or synergy-creating activity
    h. Enhancing work morale
3. **Lateral thinking – by Edward De Bono –** Lateral thinking is a term coined by Edward de Bono for solving problems through an indirect and creative approach. Lateral thinking is about reasoning that is not

immediately obvious and about ideas that may not be obtainable by using only traditional step-by-step logic.

a. Change: Harmonize the left and right brains by trying activities involving logic and imagination.
b. Read a new Book
c. Watch an unknown channel
d. Order a new dish
e. Visit New Places
f. Take a different route to reach school
g. Learn a new language
h. Develop a good Hobby

4. **Six Thinking Hats – by Edward De Bono –** This powerful technique helps you look at essential decisions from several perspectives. It enables you to make better decisions by pushing you to move outside your habitual ways of thinking. As such, it helps you understand the full complexity of a decision and spot issues and opportunities you might otherwise not notice. You must look at the decision "wearing" each of the thinking hats in turn. Each “Thinking Hat” is a different style of thinking. These are explained below:
    a. **White Hat** – With this thinking hat, you focus on the data available. Look at your information and see what you can learn from it. Look for gaps in your knowledge, and either try to fill them or take them into account. This is where you analyse past trends and try to extrapolate from historical data.
    b. **Red Hat** – Wearing the red hat, you look at the decision using intuition, gut reaction, and emotion. Also, think about how other people will react emotionally and understand the intuitive responses of people who do not fully know your reasoning.
    c. **Black Hat** – When using black hat thinking, look at things pessimistically, cautiously and defensively. Try to see why ideas and approaches might not work. This is important because it highlights the weak points in a plan or course of action. It allows you to eliminate them, alter your approach, or prepare contingency plans to counter problems that arise. Black Hat thinking helps to make your plans tougher and more resilient. It can also help you to spot fatal flaws and risks before you

embark on a course of action. Black Hat thinking is one of the real benefits of this technique, as many successful people get so used to thinking positively that often they cannot see problems in advance, leaving them under-prepared for difficulties**.**

d. **Yellow Hat** – The yellow hat helps you to think positively. The optimistic viewpoint lets you see all the benefits of the decision and its value and spot the opportunities that arise from it. Yellow Hat thinking helps you to keep going when everything looks gloomy and difficult.
e. **Green Hat** – The Green Hat stands for creativity. This is where you can develop creative solutions to a problem. It is a freewheeling way of thinking with little criticism of ideas. A whole range of creativity tools can help you here.
f. **Blue Hat** – The Blue Hat stands for process control. This is the hat worn by people chairing meetings. When encountering difficulties because ideas run dry, they may direct activity into Green Hat thinking. When contingency plans are needed, they will ask for Black Hat thinking, and so on.

Other tools –

1. Riddles, Puzzles, Rebus (Visual Puzzles).
2. Squigglers (Torrence Test) – Using common shapes as a starting point and drawing something in addition to it to create new ideas.
3. Reading, Writing.
4. Word Associations.
5. Irregular Use test – Thinking of alternative uses for everyday objects.
6. Playing with ‘what ifs, whys, etc.

HABITS

What is a Habit?

A habit may be defined as an automatic pattern of behaviour in reaction to a specific situation. Understood as a settled way of thinking/acting, it is a practised and perfected mental process to deal with a situation mechanically, with the slightest thought, to arrive at a satisfying result.

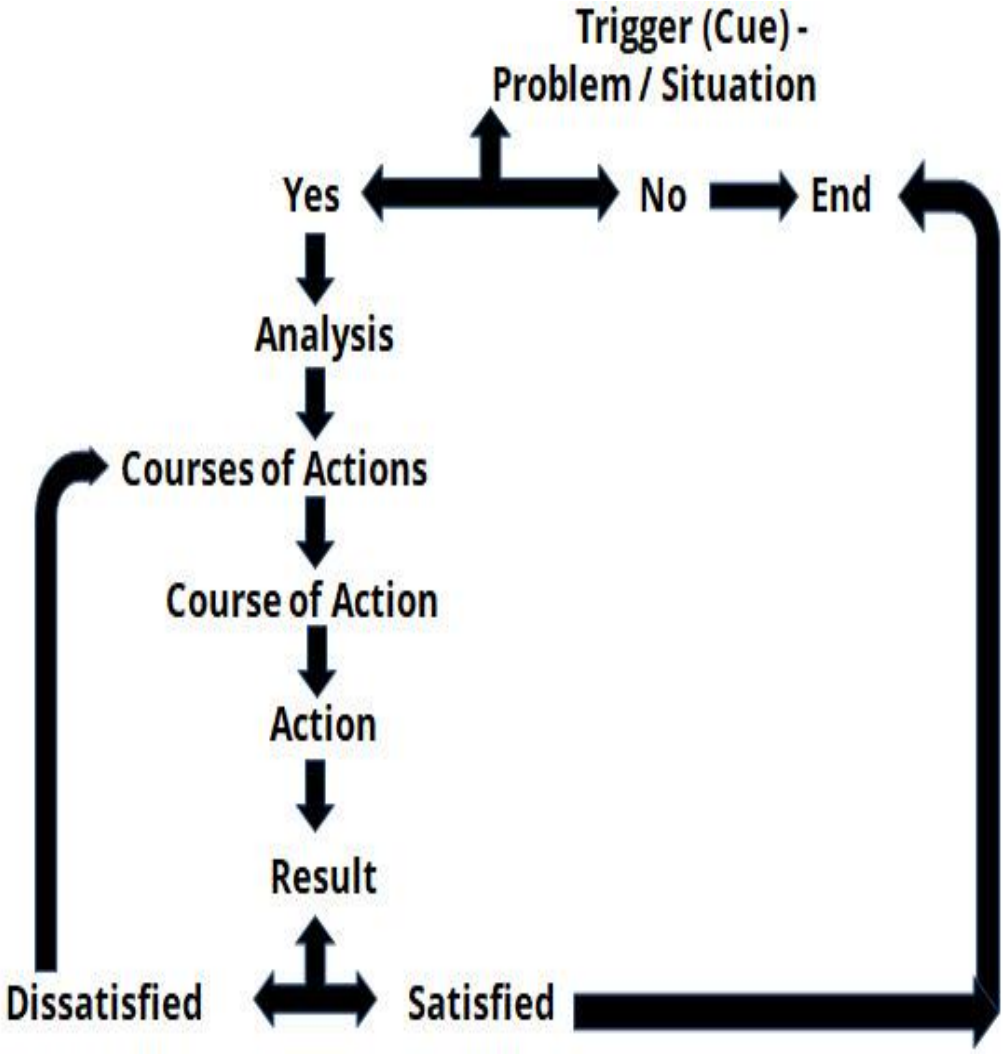
How is a Habit developed/formed?

In a specific situation, our thoughtful actions produce certain results that make us happy or satisfied. These thoughts lead to actions, and the results create neural pathways in our brains. When a similar situation arises, our brain recalls the previous successful response, deepening the neural pathway. The neural pathway becomes more ingrained with each repetition, solidifying the response pattern. Over time, the habitual repetition of this pattern eliminates the need for conscious thought, and a set response becomes automatic. This cycle of repeating patterns and consistent results is what forms habits.

Parents play a crucial role in guiding their children during their upbringing, instructing them on appropriate behaviour in diverse situations. Through consistent practice, children internalise these teachings, exhibiting similar conduct even without parental supervision.

Additionally, following family traditions and societal norms contributes to the development of habits.

Habits are also shaped by national, regional, religious, and community collective practices, whether formally codified or informally established.



Classification of Habits

Broadly, we can classify our habits into two categories –

I. Habits that contribute to the well-being of the Individual and Society are considered **Healthy Habits.**

II. Habits that do not contribute to the well-being of the Individual and Society are considered to be Bad or not-so-good habits. Some harmful habits are also regarded as **Unhealthy Habits.**

Further, we can categorise habits into three sub-categories –

A. Physical Habits – Habits which we develop through mechanical practice.

B. Emotional Habits – Habits we develop because of our emotional/affective inclination to an action/behaviour.

C. Intellectual/ Ideological Habits – Habits we develop to justify or rationalise our thought or belief system.

How are Habits Acquired?

As we move out of the strict supervision of Parents, what we see (Observe), Hear (Listen), and Feel gives new meanings based on our interpretation. This is our Perception. Such Perceptions settle down in our mind (the thinking part of the brain) to act as base data for future interpretations and actions. So, our Habits are the result of all our perceptions. Our Perceptions/Habits shape our Personality. Thus, our life moves in a specific direction accompanied by Growth. In other words, Our Growth is dictated by our Personality (Perceptions & Habits). Of course, Knowledge & Experience too contribute to our Growth.

How do habits affect us?

Habits provide us with ready-to-use responses and assured, acceptable, satisfying results and comfort zones. When we are happy with our current results/performances, we continue to do what we did earlier; thus, we remain confined to our comfort zone. Our boundary is well-defined. Unknown to us (unconsciously), we become static in our life.

How long does it take to form a new habit?

Some say that you can establish a habit in 21 or 30 days. Not necessarily. It may be more. It depends on the habit sought to be changed or acquired and the person. However, small habits are easy to develop. Since no one knows how long it will take to form the habit, it will be better to look for signs that indicate that the desired behaviour has become a habit.

How to Determine a Habit?

Habits form through a complex interplay of factors that strengthen and solidify specific behaviours. One can determine a particular behaviour to be a habit if they can relate to the following factors as part of their behaviour –

1. **Association –** Habits can be influenced by the company and environments in which they occur, as associations with particular people or contexts can shape and strengthen habitual behaviours.
2. **Efforts** – They involve the conscious decision to consistently engage in a particular activity over time, laying the foundation for the habit to take root.
3. **Consistency –** It involves repeatedly performing the desired action regularly and predictably. Consistency reinforces the neural pathways

associated with the habit, making it more likely to become ingrained in one's routine.

4. **Mindfulness:** Being mindful of one's actions and behaviours is essential for establishing and breaking habits, as conscious awareness allows individuals to intentionally shape their routines and responses.
5. **Belief:** The belief in a habit's significance and desired outcomes enhances its formation, as a firm conviction can fuel the persistence required for habit development.
6. **Repetition:** The more a behaviour is repeated, the more likely it is to become a habit, as repetition strengthens neural pathways and contributes to the automatic nature of the response.
7. **Rewards:** Associating habits with rewards reinforces their formation, as the brain learns to anticipate the desired outcomes, motivating the repetition of the behaviour.
8. **Automatic Response:** Habits are formed when repeated actions become automatic responses, requiring minimal conscious effort or thought.
9. **Comfort:** Habits often provide comfort or familiarity, making individuals more inclined to adopt and maintain behaviours that contribute to their overall well-being or satisfaction.

Habits play a significant role in shaping our personality and influencing our growth. Understanding the elements influencing habit formation allows individuals to consciously shape their routines and responses for personal growth and well-being.

LEADERSHIP

Constants versus Variables

In any task that we do, there are both constants and variables. Constants are elements or factors of tasks that remain unchanged or have a consistent value throughout. Variables are elements or characteristics of tasks that can change or be manoeuvred, influencing outcomes.

Task Orientations

Depending on the ratio of Constants V/S Variables and the number of persons required to manage them, tasks can be broadly classified into three types -

Individual Tasks – these are tasks that require only ONE person to complete them successfully. Typically, individual tasks have more constants associated with them than variables.

Relationship tasks – require mutual engagement and cooperation of a few individuals to form a bond and complete them successfully. Relationship tasks have almost equal constants and variables associated with them.

Organisation Tasks – refer to tasks requiring a relatively large number of people to come together in an organised manner to complete them successfully. These tasks can also lead towards the achievement of a common goal. More variables are involved in organisation tasks than constants, making them much more complex to manage and execute successfully.

Leadership - Definition

Leadership is guiding and inspiring individuals towards a common goal while effectively managing the constants and variables.

10 Essential Qualities of Leadership

Vision and Innovation – Vision is the farsightedness that a leader has in terms of dreaming significant, spotting opportunities, and identifying challenges or problems in the long term. Innovation is phasing out / removing all that is obsolete and successfully implementing something new (product, service, etc.), thus creating value for customers and stakeholders.

People/Customer Centric Approach – A leader needs to be people-oriented (shareholders, employees, vendors or customers) to prioritise their best interests by studying, assessing and understanding their requirements. Leaders bond with people through empathy and genuine concern for their

well-being, keeping them enthused and cheerful while maintaining the group's togetherness.

Perseverance and Resilience – Perseverance is the determination and visible effort to keep going in the face of hardship. Navigating complex and uncertain times will prove the calibre of a leader. The resilience of a leader can be understood as an internal state of mind, which is tested when there are setbacks, unforeseen threats and disruptions that can knock one to the ground. Resilient leaders can sustain their energy levels under pressure while also protecting the energy levels of their team.

Trust and Transparency – A leader must inspire trust by being forthcoming, loyal, and leading by example. The building of trust happens over some time and does not occur overnight. Transparency in leadership means keeping followers in the loop, sharing the good and the bad, and welcoming and incorporating honest feedback from team members. Transparent leaders understand and accept that it can make them feel vulnerable, yet do not hesitate in any situation.

Integrity – While honesty is knowing what is right, integrity is doing what is right; in other words, practising honesty is integrity. For personal gains, big or small, a leader should not fall prey to temptations or greed. Integrity in leaders refers to being honest, trustworthy, and reliable. Leaders with integrity practice what they preach, owning up to their mistakes rather than blaming their team or making excuses.

Empathy – Empathy in leadership refers to a leader’s ability to understand the needs of others being aware of their feelings and thoughts. An empathetic leader creates an environment where the followers feel heard, valued, and understood.

Decisiveness – A leader must be able to assess any situation quickly and, having identified the centrality of the problem, decisively deal with it. To be able to do so, a leader must study the pros and cons of the various options available and choose the best course of action. Further, a leader should exploit fleeting opportunities that present themselves. Quickness, timeliness and appropriateness of decisions are essential.

Adaptability – A leader needs to adapt oneself to ever-changing needs and times. The hallmark of an adaptable leader is the flexibility to accept new ideas, people, and challenges and move out of one’s comfort zone and familiar territory. It is like water taking the shape of the container in which

it is poured without changing its fundamental characteristics. Open-mindedness and willingness to learn anytime, anywhere and from anyone indicates an adaptable mind.

Accountability – Accountability refers to the leader's willingness to accept responsibility or to account for one's actions without shying away from taking responsibility. It can be in terms of acknowledging any mistakes or errors that might have occurred and working towards fixing them.

Confidence – A leader must have faith and conviction in self while displaying self-confidence for others to see and perceive. This will inspire confidence within the group and positively impact their performances.

Leader – Definition

An individual possessing leadership qualities, effectively managing constants and variables, is considered a leader.

Categorisation of Leaders

Individual Leaders – In individual settings, we come across leaders who have made a mark on the world. For instance – Swami Vivekananda, Ratan Tata, Narayana Murthy, Falguni Nayar, Kiran Mazumdar Shaw, Falguni Nayar, Vineeta Singh and many others.

Market Leaders – In the business sense, we come across companies that have become market leaders by the decisions and actions of the able leadership at the helm, like Wildcraft, Zerodha, Ather, and many others.

Leaders – Leadership – Aham (The Indian Concept of Self) –

Leaders and their Leadership abilities are built upon the principles of **'Self'**. Self, as per theoretical and empirical research, has a structure made up of four components –

1. Identification
2. Individuality
3. Agency
4. Separation

Let us understand the meaning of these words in the context of the theory as developed by retired professor Dr. Kiran Kumar Salagame, Department of Psychology, University of Mysore.

1. **Identification** – Right from birth, we cultivate this simple habit of identifying things and people as mine. The fundamental belief of associating with many things as "I and Mine" sets off the idea of Identification. My parents, my country, my tradition, my belief system, my toys, my devices, my documents, etc…. the list goes on endlessly!
2. **Individuality** – Every being has an ambition! These ambitions are built on one's outlook towards life and, more importantly, one's capability to achieve the set ambitions. As a being achieves more and more of their aspirations, many abilities start to unfold. These abilities and how they are employed under different situations for a specific result are unique to an individual, which distinguishes every being from the other! These abilities go into our Bio-data. These abilities, otherwise known as **innate individuality**, determine the quality of life, attitude, aptitude, belief systems and behaviours.
3. **Agency** – If one recognises you as an industrious and smart personality, it is a reward! This reward exhibits your individuality. But how did you arrive at such an individuality? You put in the necessary efforts to become industrious and intelligent. This effort **to do** or your **doer-ship** is known as agency. From birth till death, man endlessly displays his doer-ship—however, only meaningful doer-ship results in meaningful living.
4. **Separation (Differentiation)** – Right from birth, we have the habit of identifying things and people as mine, which comes under 'identification'. On the contrary, when we say something or someone is not mine, that is when the idea of separation finds an expression. "My country is mine because your country is not mine!" "My lifestyle differs from yours because I don't subscribe to your lifestyle!" This concept of "not mine" separates every being from the rest. Many things, from our fingerprints to ID cards, uniquely distinguish us**.**

Collectively speaking, a leader is known for his skills when he is high on individuality. Suppose one observes and understands the list of ten essential qualities of a leader; an inevitable realisation dawns upon us, that these qualities take a lot of time to grow and flourish within us.

If these qualities ever find an expression, **Individuality** is established. To establish these ten qualities, the **Agency** required is equally high. One should put a tremendous amount of personal hours and effort into developing such qualities against all odds. It is straightforward for children and adolescents to create a sense of identification with their devices, goals, lifestyle choices, belief systems and so on. But to continue to live like this forever is detrimental to one's growth, evolution, maturity and stability. The sense of **Identification** we develop with materialistic things should only be a by-product of what we have accomplished through thoroughly nurturing our individuality. If **Identification** is born out of our excessive attachment to materialistic aspects, such a living is termed narrow and shallow. Such an identification will potentially make a leader ordinary. Only ordinary leaders driven by a higher sense of identification narrow down their leadership to a small group of people and **Separate** their identity from the rest of the world.

A true leader is accommodative and inclusive, forming a solid bond with a larger group for a more significant cause.

Let us evaluate and constantly check if our growth is inclined more towards Individuality and Agency or Identification and Separation, as we now know the positive impact Agency and Individuality can have on our personality.

INDIAN MATHEMATICS

Do you remember reading about Harappa and Mohenjo-Daro in your high school history textbooks? If you thought Harappa and Mohenjo-Daro were just historical accounts, it is time to review your thoughts!

Harappa and Mohenjo-Daro, also known as the Indus Valley civilisation, is where most Indians can trace their ancestry. Our journey begins at the height of the Indus Valley civilisation, one of humanity's first great civilisations. Archaeological evidence reveals the Indus people used tools to measure length and mass, implying basic mathematical knowledge. Seals and tablets also contain numerical inscriptions, suggesting the Indus could count and keep records. So, while few written records survive, precise mathematics played a functional role in the Indus Valley civilisation.

Did you listen to those words? Measurement, numerical inscriptions, mathematics? The story of mathematics in India is truly magnificent, spanning over 4000 years of human intellectual journey. In this video, we will trace India's epic mathematical voyage across the ages, from ancient times to today.

I am sure you know that India’s contribution to mathematics is the number Zero. But did you also know that Indians taught the world Infinity? The next time you say – “I love you infinitely” to your parents, lover or even pet”, say so with extra pride! Srinivasan Ramanujan, an Indian, taught Infinity to the world!

Ah! Did you know this fact? In 2015, a movie – A Man Who Knew Infinity in the Name of Srinivasan Ramanujan, was released!

Have you heard Mantras chanted in a temple like this, or have you seen these rituals performed in the presence of fire? If you thought this was a random religious practice meant to please Gods and Goddesses, then you probably have a piece of minimal information.

Look at the geometrically arranged bricks – some circular in form, some triangular in shape, and one in the form of a bird! If you thought they

appeared simple, you are deceived by their simplicity! Do one thing – Go to a construction site and collect bricks and give it a shape as you see on the screen! You will struggle and, for sure, require multiple iterations. If you complete the task successfully, you will learn geometry in application!

This early mathematical expertise found fuller expression during the Vedic Era. The most critical Vedic texts were the four Vedas, containing the earliest known Indian mathematical scripture called the Shulba Sutras (शुल्ब-सूत्र). These were composed by Vedic sages like Bodhayana (बोधायन). In the language of mathematics, it is called a formula, and in Sanskrit, it is addressed as a Sutra.

The Shulbasutras outline geometric constructions of altars for rituals. Most strikingly, they contain what is essentially Pythagoras' theorem centuries before the famous Greek philosopher. Bodhayana's Shulbasutra states the famous Pythagoras theorem for right-angled triangles and offers more ancient geometric proofs than the Greeks. Sage Apastamba's (आपस्तम्ब's) Shulba Sutra contains early numerical evidence for the general Pythagorean theorem, suggesting its origins in India.

Did you know this? The University of Manchester, after a lot of research, confirmed that the Indians predated Newton's discovery by 250 years!

The Shulba-sutras showcase sophisticated mathematical concepts, reflecting Vedic era insights over 4000 years ago. These ancient texts employ iterative algorithms to compute square roots of numbers, revealing a rudimentary form of calculus, which would later be formalised in Europe. The authors adeptly solve quadratic equations and provide geometric principles such as similar triangles and circle properties, transcending Pythagoras' theorem.

You might be wondering – So what? What if Indians achieved these things? Why should I know about it today?

Well, take some time and recall these statements you have heard since childhood! German cars, Swedish chocolates, American Technology, Italian

Pizzas, Clean Singapore, the Finnish Education system, French cosmetics and so on! Despite a move towards globalisation, each country takes pride in what they have achieved and what they currently do and intend to do in the future!

Similarly, the Indian contribution to the growth of the world in the past has been immense, and it will continue to be vast in the future. Therefore, knowing the past is essential to making our future the best!

Returning to ancient Indian Mathematics, the Shulba-sutras contain early instances of dealing with irrational numbers, predating Greek engagements with such concepts. This rich blend of theoretical and practical application laid the groundwork for enduring mathematical principles, making the Shulba-sutras foundational for geometry and fundamentals to ideas later developed in algebra and other fields.

Entering the early centuries CE, India experienced a flourishing era in mathematics, led by the luminary Aryabhata, born in 476 CE. Aryabhata's monumental work, the Aryabhatiya, marked the dawn of modern mathematics in India. Pioneering the decimal place value system, Aryabhata introduced zero as a placeholder.

Every electronic device we use is made of an Integrated Circuit, also known as an IC. IC design and even aircraft design require the knowledge of geometric progressions. Aryabhata's arithmetic algorithms have aspects of square roots, cube roots, and geometric progressions. By calculating pi with remarkable precision at 3.1416, Aryabhata laid the foundations for trigonometry by defining sine as the modern ratio of half a chord and radius and creating the first Indian sine tables.

Brahma-sputa-Siddhanta of Brahmagupta taught the world the principles of arithmetic, algebra, and astronomy. Crucially, he formulated rules for negative numbers and zero, a concept Europe grasped centuries later.

Have you heard the mathematical phrase – quadratic equations? The quadratic equation has several applications in computer programming. It is

often used in computer graphics, physics simulations, optimisation problems, and algorithm analysis. Brahmagupta provided solutions for quadratic equations, relying on area computations more than algebraic manipulation. Over subsequent centuries, mathematicians like Bhaskara I and Bhaskara II expanded their knowledge of trigonometry and number systems.

So what enabled such brilliance across centuries? Partly, it was an education system where pupils entered residential schools called gurukuls focusing on metaphysics, warfare, literature and mathematics alongside spiritual texts like the Vedas. Students built upon teachers' wisdom over the years until graduating. Royal courts also patronised academic works by visionaries like Aryabhata, providing institutional support and enabling significant strides in mathematical theory.

Now, we shift our focus to medieval South India, where the influential Kerala school, centred around the princely states in the Kerala region, emerged. Key figures in this mathematical lineage include Madhava of Sangamagrama, along with mathematicians Nilakantha Somayaji, Jyeshtadeva, and others. This school achieved groundbreaking discoveries comparable to those of 17th-century European luminaries but centuries earlier. In the 14th century, Madhava formulated a version of the renowned Taylor series expansions for sine, cosine, tangent, and arctangent functions. Leveraging these infinite series, he accurately calculated pi to 11 decimal places—a record unsurpassed for centuries. Madhava established profound connections between geometry, algebra, and calculus, laying the groundwork for subsequent advancements. In the 15th century, Nilakantha further developed Madhava's ideas, producing the Tantrasamgraha text. Nilakantha devised and applied sophisticated Taylor-like power series formulas while achieving significant strides in computational astronomy. The mathematicians of the Kerala school demonstrated a level of mathematical insight comparable to later European intellectual giants such as Newton and Leibniz, remarkably anticipating their discoveries in mathematical analysis by centuries.

Entering India's colonial era, a complex interplay unfolded between Indian and Western mathematical ideologies, marked by enrichment and the repercussions of British imperialism. By 1757, knowledge flowed in both directions as the British Empire asserted control. Indian mathematical treasures like Lilavati and Brahmagupta's texts were translated into English, introducing concepts like the flexible decimal number system to Europe. However, this period eroded India's traditional educational systems, disrupting centuries-old networks that fostered mathematical innovation. The imposition of Western-style education replaced the holistic learning of gurukul schools, where mathematics coexisted with spiritual and literary studies. This transformative phase, marked by exchanges and disruptions, reflects the intricate dynamics of colonial-era intellectual encounters.

In the colonial period, despite the overall decline in Indian mathematical thought due to British imperialism's disruption of traditional educational systems, remarkable individuals like Srinivasa Ramanujan and Prasanta Chandra Mahalanobis emerged.

A self-taught genius, Ramanujan revolutionised number theory with over 3900 theorems, showing parallels with European mathematicians. Recognising his genius, British academics brought him to Cambridge, where he flourished despite initial challenges. Despite his early death, Ramanujan left a profound mathematical legacy.

Mahalanobis, an agricultural officer, pioneered statistical methods for crop surveys in India and founded the Indian Statistical Institute, contributing to quantitative research on India's economic and social conditions during the colonial era.

As the twentieth century unfolded, Ramanujan created a new legacy as Indian mathematicians built upon their civilisation's distinguished legacy. In the 1930s and 40s, thinkers like S.S. Pillai, K. Ananda Rau and Ganapati S. Mudgal blazed new trails in number theory and algebra. However, the most influential figure from this era was probability theorist C.R. Rao, who transformed experimental design and analysis approaches across scientific, industrial, and social research domains. Rao's innovations in multivariate

analysis and differential geometry rate alongside legends like Ronald Fisher and John von Neumann.

In the post-independence era, India has fostered a robust culture of mathematical research, actively promoting science and technology through educational initiatives. Esteemed institutions like the Tata Institute of Fundamental Research and the Institute of Mathematical Sciences have attracted global talent, solidifying India's position as a mathematical powerhouse.

The Fields Medal is a prize awarded to two, three, or four mathematicians under 40 at the International Congress of the International Mathematical Union (IMU), a meeting every four years. The name of the award honours the Canadian mathematician John Charles Fields. The Fields Medal is regarded as one of the highest honours a mathematician can receive and has been described as the Nobel Prize for Mathematics. Contemporary Indian mathematicians excel internationally, with notable achievements such as Manjul Bhargava becoming India's first Fields Medallist in 2010 for innovative generalisations of Gauss' composition laws. Akshay Venkatesh, another luminary, received the Fields medal in 2018 for groundbreaking work in dynamics and number theory. Pioneers like Kannan Soundararajan continue to advance analysis and number theory through groundbreaking research.

India's mathematical heritage, predating European acceptance of core ideas, was highlighted in the 2010 International Congress of Mathematicians in Hyderabad, featuring global luminaries like Fields medallist Terence Tao. Despite historical setbacks, India's strengthened educational and research ecosystems signify a global ascent, building upon an intellectual tradition spanning millennia.

Our exploration of Indian mathematics spans 4000 years, from Vedic origins to a golden age with Aryabhata, Brahmagupta, and Bhaskara II. Despite challenges, the discipline endures, propelled by Kerala's medieval luminaries and contemporary figures like C.R. Rao. Today, Indian mathematics flourishes globally, drawing inspiration from rich cultural

legacies as new generations propel forward guided by boundless imagination.

INDIAN METALLURGY

Metallurgy has a vibrant history in India, spanning thousands of years. Ancient Sanskrit religious and philosophical texts contain numerous references to using different metals in the Iron Age civilisations that flourished on the Indian subcontinent.

Remember the straightforward information you studied in the 6th or 7th standard? The world's oldest book on the planet is Rigveda, and yes, it mentions the word "ayas", which translates to metal. Is it any special? Yes, metals exist in nature, but they must be extracted. So, the Indians learned metal extraction perhaps 5000 years ago! The two other significant sources of Indian history - Yajurveda and Atharvaveda, available in Sanskrit, contain references to skilled metal workers known as "smiths" and descriptions of early smelting processes used to extract metals from ore.

Archaeological evidence indicates advanced techniques of using metallic tools for activities like agriculture & cooking. Minting coins were developed thousands of years ago during the height of the Indus Valley Civilization, which is contemporary to ancient Egypt and Mesopotamia. Metals ranging from copper to gold were expertly transformed into finely detailed statues, idols, lamps, jewellery and various artistic objects across the diverse cultural landscape of prehistoric India.

The famous rust-resistant Iron Pillar, known as 98% wrought iron, located in modern-day Delhi, is a testament to the incredibly high skill level of Indian metallurgists and blacksmiths dating back over 1600 years. Constructed during the reign of Chandragupta II Vikramaditya sometime around 375-415 CE, the 7.2-meter-tall pillar has miraculously withstood over a millennium of harsh Delhi summers, monsoon rains and winter fog without corrosion or rusting. The production of such advanced corrosion-resistant iron using technologies available more than 1500 years ago still astounds modern-day material scientists and metallurgists.

Ah! Like many people express joy to see their favourite imported items come from other parts of the globe, the Ancient Romans mention trade with India, which included superior Indian iron and steel, used exclusively for

armour and cutlery. So, to fight a war and have food, Romans stared at the ship on the sea, superior carrying Indian metals! In the Medieval era, the renowned 9th-century Indian alchemist Nagarjuna authored "Rasaratnakara," detailing methods to extract and purify gold, silver, tin, and copper from ores. His work revealed early distillation processes, showcasing Indian alchemists' pioneering advancements predating medieval Europe.

Many Indians wouldn’t have heard the Jaivana cannon. Jaivana Cannon showcases the scientific strength of ancient India. Constructed during the early 18th century under the rule of Sawai Jai Singh II, the Jaigarh Fort commands the Aravalli Hills, strategically overlooking its counterpart, the renowned Amber Palace-Fortress. Linked intricately to Amber, these forts formed a crucial defence network, offering the Rajput Kachwaha rulers of Jaipur a great advantage. Jaigarh housed an advanced cannon foundry, epitomising the sophisticated metallurgy of medieval Indian arms production.

Endowed abundant mineral resources, including iron ore mines, Jaigarh emerged as a colossal weapons manufacturing hub. Its innovation extended to a vast furnace blast chamber, ingeniously powered by wind tunnel technology utilising airflow from the surrounding hills. The resultant temperatures exceeded 1,320°C, enabling the smelting of Raj's iron cannonballs. Among its formidable creations stands the Jaivana cannon, a 50-ton behemoth manoeuvred by elephants—unrivalled in size before modern industrialisation. Forged from local Dhrangdhra iron ore, its 20-foot barrel propelled 100-pound cannonballs over 35 kilometres, marking the zenith of medieval Indian metallurgy. Yet, this pinnacle reflects a monumental 7,000-year legacy of advanced metalworking, underscoring the enduring scientific and technological prowess of the Indian subcontinent.

India was blessed with an abundant diversity of metallic natural resources. Gold, copper, silver, zinc, lead, tin, iron and even toxic mercury were mastered in approximately their relative order of discovery by skilled Indian smiths, miners and metallurgists. The first evidence of metal usage in the region corresponds to tiny copper beads dating back to around 6,000 BCE

unearthed at the pre-Harappan site of Mehrgarh, Baluchistan, located at the western edge of the Indus river plains. However, extraction and purification techniques were still relatively primitive, based on hammering native copper deposits rather than smelting ore.

During the maturing Bronze Age of the Indus Valley Civilization, advancements in smelting technology thrived through extensive trading networks reaching Rajasthan and Oman for tin and copper ores. Excavations in the Northwest reveal smelting furnaces, crucibles, and moulds, showcasing a flourishing metals industry. During the Harappan period, the mastery of smelting transformed copper ore into bronze, and the optimal tin-copper alloy ratio was achieved. This technological finesse, adjusting alloy composition with trace metals, heightened bronze's corrosion resistance, making it superior for weapons and tools. Harappan artisans demonstrated their uniqueness by mass-producing intricate bronze wares, including the famed "Dancing Girl of Mohenjo Daro."

In addition to bountiful copper and tin, geological surveys have uncovered extensive evidence of ancient mining activity extracting gold, silver and pale gold-silver alloy known as electrum, primarily from the Kolar Gold Fields region of present-day Karnataka state. These precious metals were fashioned into the stunning jewellery pieces discovered at major Harappan sites. Harappan trading networks also imported gold, silver and gemstones from Afghanistan, Iran and Mesopotamia. In the centuries following the decline of the significant Harappan urban centres, we have witnessed a reduction in advanced bronze metallurgy across North India.

During the late Bronze Age, the "Copper Hoards" culture expanded copper tool production in Central India, using less advanced casting methods. Major religious iconography traditions also established ritual consecration of primarily copper and bronze murtis around this transitional period before the Iron Age.

The extraordinary skills of classical Indian bronze sculptors reached their heights during the Chola dynasty period in Southern India, which produced stunning bronze masterpieces of Hindu, Jain and Buddhist figures, including the cosmic Nataraja Shiva statues famed for philosophical symbolism.

The Iron Pillar in Delhi stands alongside the ancient production of legendary Damascus steel, wootz. Invented in Southern India, Damascus steel was exported to the Middle East for crafting Damascus sword blades.

European Crusaders marvelled at the sharpness of Indian wootz steel exported as raw material for Damascus blades. Perfected by elite Arab and Persian blacksmiths, the high-carbon wootz billets formed the foundation for the legendary cutting properties of historical Damascus swords. Modern analysis of Damascus sword samples confirms exceptionally high carbon levels, surpassing 1%, comparable to advanced 20th-century alloys. Reproduction studies show that Wootz crucible ingot structure and ultra-high carbon content contributed to the remarkable cutting and resilience, pre-dating similar European alloys by over 1500 years.

Dominance over the production cycle of critical strategic metals, primarily iron, has secured political and military power throughout Indian history. Specific caste occupational guilds like the Agaria have specialised for countless generations in iron production across central India, spanning parts of Uttar Pradesh, Madhya Pradesh, Bihar and Jharkhand states. Their extraordinary empirical expertise in extracting iron from ore and forging crude furnace products into incredibly diverse tools and implements has been integrally intertwined within rural village economies even into early modern times.

During the prosperous medieval period, Indian exporting of surplus high-grade iron and steel, including specialised forms like wootz, enjoyed international solid demand and contributed substantially to commercial trading economies. Even the prominent Arab explorer Idrisi wrote flatteringly in the 12th Century CE that "...Hindus excel in the manufacture of iron... it is impossible to find anything to surpass Indian steel...". Yet despite the resilient technological lead in metallurgy processes, the structured control over access to mineral resources and global trade dominance established by the ruthless British East India Company triggered the rapid decline of the traditional Indian iron industry from the 18th century onwards through the exertion of geo-political power rather than competitive market dynamics alone.

With a remarkable 7000-year legacy, India's advanced metallurgy has shaped dominant civilisations celebrated for innovation, art, and philosophy. Icons like the corrosion-resistant Delhi Iron Pillar and the strategic Jaigarh super-cannon underscore the extensive economic investment in military metallurgy. Accounts of legendary Damascus steel and Chola bronze Nataraja statues hint at India's unique mastery of advanced materials

science. This legacy spans three millennia, deserving a revival as India ascends as a global power, drawing inspiration from its rich heritage in the complete natural resource-to-technology production chain of strategic metals.

INDIAN ASTRONOMY

Have you ever been fascinated, shocked or put in wonders by looking at the sky and its vastness, and maybe thought about the mysteries that those stars and galaxies hold within them? You must have a glimpse of what our ancestors and the very ancient people thought, imagined and discovered about the universe without having all those high-tech instruments and technology back then; however, they might have had even better techniques and instruments that, too, without causing any harm to the environment and eco-system.

The earth was considered flat for a very long time, but then, in the fifth century, we discovered that it was round; the Sanskrit word for Earth is Bhugola, where Bhu means Bhumi (land) and gol means round. Another word for Earth is Jagat, which means something with a certain speed; therefore, earth was never considered stationary. The Sanskrit term to define the solar system is Suryamalika, where Surya means Sun and Malika means garland, so we knew that the Sun was in the centre and the planets were moving like a garland around the Sun. Our ancient temples already had a heliocentric view of the solar system, where the sun is kept in the middle between the Navgraha statues.

The sun rises in the east! Does the moon rise, too? Yes! Moon rises too in the East. Interestingly, the moon increases daily with the background of a particular group of stars. The ancient Indians mapped these 27 points of the moon-rise in the night sky with the naked eye. 27 such star-constellation at the backdrop helps us identify the days of the month, which also gave birth to the idea of the Indian calendar. Isn’t it fascinating that the ancient Indians observed this phenomenon centuries ago with such precision?

Let me take you to ancient India and the present times in India, where a living tradition exists today, going back an unbroken chain of almost 8000 years. This is the tradition where newlywed Indian couples are prompted to come out and look at the binary star called “Vasistha-Arundati” in the night sky as a measure of auspiciousness. Vasistha-Arundati stars are part of the

constellation “Sapta-Rushi”. Vasistha was a Rushi who lived in ancient India. A Rushi is a wise man who is very enlightened and understands reality. Vasistha lived in his hermitage with his wife, Arundhati, who is revered even today as an epitome of innocence and virtue. Of all the visible binary stars in the sky, the ancients selected Vasistha and Arundhati as auspicious. The fascinating reason behind this is that it turns out that, from our studies today of all the visible binary stars, we know that the great majority of them are such that the most prominent star gravitationally holds the smaller orbiting companion. And the smaller companion goes around the most prominent star. However, we know that this is not the case for Arundati-Vasistha. Arundati-Vasistha is gravitationally bound because Vasistha goes around Arundhati while Arundhati goes around Vasistha. In other words, they co-orbit each other. The ancient Indians observed this phenomenon and called this out as an exemplar of what an ideal marriage relationship should be. So, they vowed this into a tradition that, for over 8000 years, newlywed couples have been prompted to look at that as a message of how to conduct themselves in a relationship.

One more story of ancient times, where Moon married the 27 daughters of King Daksha. The story goes that, each day, the Moon would visit one of his wives. However, King Daksha's father-in-law got word that the Moon favours one of his wives, Rohini, much more than the other. Daksha was furious with his son-in-law. How could he not treat his daughters equally? He curses his son-in-law, but the Moon manages to plead with the God Mahadeva, and he gets a boon from Him and is condemned to a life of waxing and waning. This enchanting story has encoded complex as well as simple astronomical facts. The ancient Indians observed that the moon rises in the east at a different time each day and, therefore, at a different backdrop of the sky and the stars. They also observed that it took around 27 days for the moon to return to the same backdrop of sky and stars. So, they decided to divide the 360-degree sphere into 27 sections. They looked for the brightest star for each of these sections and named each star as one of the moon's wives. These were the “NAKSHATRAS”. Nakshatras are loosely translated as lunar mansions. So, the 27 Nakshatra model is precisely that. Ancient Indians evolved a very powerful pneumonic using the pneumonic of the moon's wives’ names; they could come out and look at the night sky

and recognise the principal stars in it as well as associate them with the phases of the moon and thus mark the passage of time. This mechanism of passage of time has been used in India for a long time, even today, to mark festivals using such a lunar calendar.

The astronomy of this land was reflected in the temple architecture and was even found in the temple's inscriptions.

There is a fascinating mystery called “Baana Stambha” in the ancient Somnath Temple in Gujarat. On the temple's south side, overlooking the sea, is a pillar called “Baana sthamba”. An arrow is built on the top of the pillar, which points towards the sea. The existence of this pillar is mentioned in some ancient books from the 6th century. There is an inscription carved on the pillar in Sanskrit – “आ-समुद्रांत दक्षिण ध्रुव-पर्यंत अबाधित ज्योर्तिमार्ग" (“there is no earth terrain from this point of the sea to the South Pole) Now the fun fact. If you start travelling from Somnath Mandir towards the South, you will not find any mountain or piece of land until you reach the South Pole (Antarctica), which is 10,000 km away. So, how did our ancestors know this fact in the 6th century? Did they have an aerial map of the earth? What degree of knowledge of astronomy, geography, mathematics, and maritime sciences must they have had?

Our ancient Indian heritage is indeed a marvel! Surya Mandir is located in Konark. It was built in the 13th century. Konark is considered a holy place in Odisha due to this Surya mandir, one of India's most magnificent architectural structures. A wonder is dedicated to the lord the sun. The building is a chariot of the lord sun with a significant blend of culture, architecture, and astronomy. The temple’s construction is so that the first ray of the sun is held on the sun-gold throne through the gates. The ray of the sun passed from the door of the temple. The door of the temple is built in such a way that the sunray can pass through it in all seasons. As the latitude of Konark, the vertical sundial is designed according to that particular way. The shadow made by the sundial shows the exact time. Till the 14th century, the mechanical clock was not invented. So, the sundial was the best way to address time.