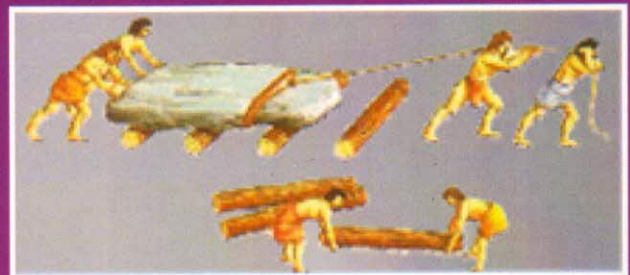


MAN AND HIS QUEST FOR ENERGY

Professor J. S. Rao

President

The Vibration Institute of India



Man and His Quest for Energy

A Story for Everyone

Professor J S Rao

President, The Vibration Institute of India

Chief Editor Journal of Vibration Engineering and Technologies

Chief Science Officer (Consulting), Altair Engineering

Bangalore

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Krishtel eMaging Solutions Private Limited, Krishtel eMaging Solutions Private Limited,
(New) Door No. 3/2, Plot No. 68, Ist Floor, Kadamban Street, M.S.M. Nagar, Valasaravakkam,
Chennai 600 087, India; Tel : +91 44 24861316

Email : jvet@krishtelemaging.com

Registered Office

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Preface

We have gone through three industrial revolutions, James Watt Steam Engines era, de Laval, Faraday, Timoshenko turbo-machinery and Dynamo and the approximation of Science to Engineering, Electronics revolution and now we are in the IV Industrial revolution era also called Digital revolution. Our teaching approach has also and is also responding to these periods; Science split itself into different engineering domains about 100 years ago and returning to Science in full swing ushering Simulation of Solid Mechanics, Fluid Mechanics and Electromagnetics early this 21st century and through commercial means to digital revolution of applying finite element or finite volume solutions of coupled partial differential equations of the multi physics phenomena and rapidly minimizing the design cycle time. We have to bring our students to this stage for the capabilities of meeting the challenges in today's advanced design world.

When we try and get the students motivated to prepare them for the 4 year undergraduate course, it is found best to introduce to them the history of development of science and engineering domains over the 13 millennia ever since the last ice age ended and man has come out of the caves and mastered over the ferocious and physically powerful animals through friendly means or otherwise through technology. This book outlines this story without any theory and in a cartoon form so that they appreciate and understand what they are going to learn during four years according to the current IV Industrial revolution era.

Just one or two hours a week is all that is required as the school prefers.

J S Rao

To my beloved wife Indira

Man and His Quest for Energy

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1. The Beginning of Modern Man

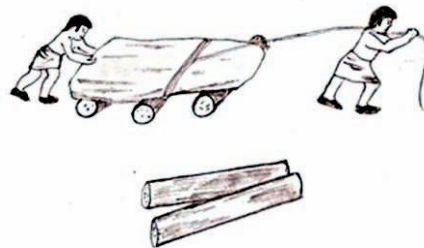
About 15000 years ago, the ice age ended and men began to move around and venture out



In tropical and temperate forest regions, Paleolithic tools were chipped to protect themselves and gather food by killing animals.



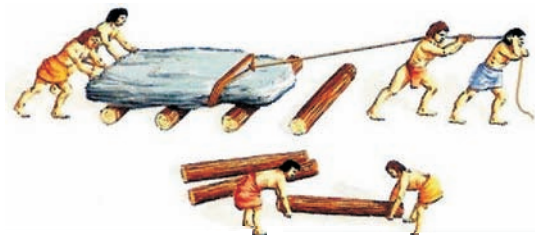
In this period, man found that a section of the tree trunk was able to move under gravity because it was round.



If the branches and twigs of the trunk were removed, the speed of the rolling log improved. The sledge was invented as a forerunner for the cart.

2. Development of Wheel – Fundamental to Modern Civilization

Men then began to combine the roller and the sledge. As the sledge moved forward over the first roller, a second roller was placed under the front end to carry the load when it moved off the first roller.



With the newly acquired skills of mobility men began to settle and develop agriculture 10000 years ago; Stone tools became highly polished and varied in this period of Neolithic or New Stone age.



People began to settle and built villages 5000 years ago as in ancient Indus Valley Civilization.



During this time the slow potter's wheel, was invented by Egyptians which developed into the fast wheel, first used at Ur in Mesopotamia.



The wheel is probably the most important mechanical invention of all time. From tiny watch gears



to automobiles



to jet engines



and computer disk drives, the principle is the same.



The first use of the wheel for transportation was probably on Mesopotamian chariots in 3200 BC.



The wheel was furthered and improved by the Egyptians around 2000 BC, who made wheels with spokes. In Ancient India, chariots with spoked wheels were also discovered around 1500 B.C.



1500 years ago the wheel became widely used for war machines. The grinding wheel was introduced in Arabia that greatly improved the effect of bladed combat weapons.



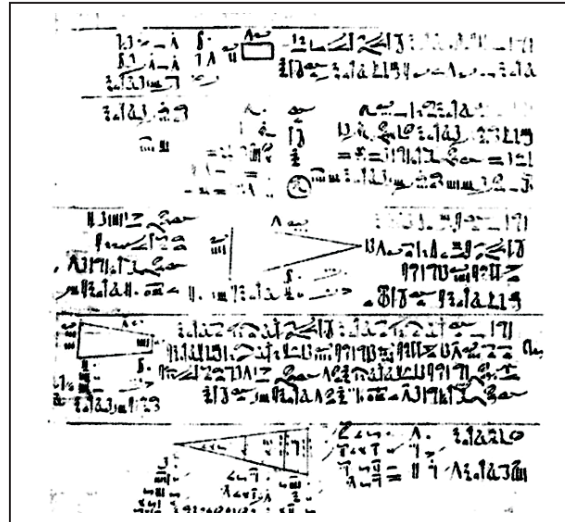
In ancient times, Religion and superstition ruled in different parts of the world.

There is very little or no evidence that suggests philosophical or scientific thinking existed till the tracing of Algebra to ancient Babylonian mathematicians roughly 4000 years ago, who developed a positional number system.

3. Mathematics Paves the Way to Explain Physical Phenomena Around

Ancient Egyptian algebra dealt mainly with linear equations while the Babylonians found these equations too elementary and developed mathematics to a higher level than the Egyptians.

The Rhind Papyrus, is an ancient Egyptian papyrus written 3800 years ago by Ahmes, It is the most extensive ancient Egyptian mathematical document known to historians.



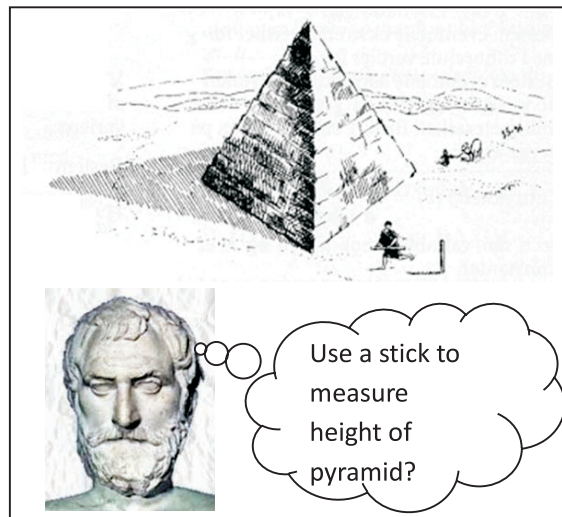
Sushruta was an ancient Indian surgeon around this time and is the author of the book Sushruta Samhita, in which he describes over 300 surgical procedures and 120 surgical instruments and classifies human surgery in 8 categories. He lived, taught and practiced his art on the banks of the Ganges in the area that corresponds to the present day city of Benares in North India.

Sushruta was the first to make use of the magnet for surgical purposes.



4. Philosophical Thinking

Thales of Miletus (624 BC - 546 BC) was a pre-Socratic Greek philosopher from Miletus in Asia Minor, and one of the 7 Sages of Greece. He attempted to explain natural phenomena without reference to mythology and was tremendously influential in this respect. Thales used geometry to solve problems such as calculating the height of pyramids and the distance of ships from the shore.



About 2700 years ago geometry from Egypt was imported and Greeks began to develop it and arithmetic into separate branches of mathematical science. In the next several hundred years, Socrates (469-399 BC), Hippocrates (460- 370 B.C.), Plato (428-348 B.C.), Aristotle (384-322 B.C.), Euclid (323-285 B.C.), and others systematized what was then known about geometry and arithmetic.

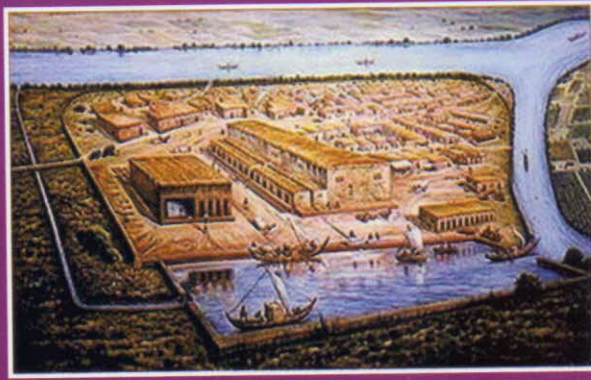
Dark ages or medieval period follow after these golden years of beginnings on thinking in a logical manner. Over a millennium would be lost and science takes a backward seat to religion and superstition. Renaissance will take place as precursor to a revolution on science in 17th century that will see an unprecedented growth and awakening in the future of world.

Socrates was a Classical Greek Athenian philosopher and is credited as one of the founders of Western philosophy, He developed "logic" in which a series of questions are asked not only to draw individual answers, but also to encourage fundamental insight into the issue at hand, and this approach remains strong in providing a foundation for much western philosophy that followed.



Socrates lived during the time of the transition from the height of the Athenian hegemony to its decline with the defeat by Sparta and its allies in the Peloponnesian War. Despite the troublesome and chaotic period, Socrates was able to make profound influence on Philosophy and Logic that laid the foundations for next two and half millennia of scientific and technological development.

Philosophy and Logic from Socrates may have given to birth to Science in this transition period of human settlements that were raged on one hand by religion and superstition and wars on the other hand. Can we expect that even from birth that science shall be perfect? Evidently not. It would take another two painful millennia to develop and perfect an understanding of science during scientific revolution.



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