iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VI Month of publication: June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54173

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Study on Partially Replacing Cement with Groundnut Shell and Sugarcane Bagasse Ash with adding Asbestos Fibre

Nikhil Kumar[1], Sourabh lalotra[2]
[1]PG Scholar, [2]Assistant Professor, Sri Sai College of Engineering and Technology, Pathankot, India

***Abstract:** The industrial waste contains many inorganic and toxic substances far away the acceptable limit which cause an impact on the environment. Scarcity of the const. materials used the natural resources like sand aggregates and stone aggregate. The partial replacement of aggregates is need for the future generation of concrete structures for the environment supportable. The partial replacement of aggregates is need for the future generation of concrete structures for the environment supportable. The depletion of the natural resources gets exhausted. We have think over the alternate replacement of the materials. In present work the partial replacement of the GSA,SBA with the Cement and the addition of asbestos fiber. Optimum value of strength in compression, split tensile and flexure came at GSA,SBA 12% replacement with the Cement and addition of asbestos fiber 0.5%. The workability of mixture increases and after that there is decrease in the workability of the concrete when we increase the percentage of GSA,SBA with the Cement. A series of experiment were carried out to measure the compressive strength, split tensile strength and flexural strength of the concrete. The results showed that the compressive strength, split tensile strength and flexural strength increases with the adding of the GSA,SBA with Cement and the addition of asbestos fiber.*
***Keywords:** GSA (Groundnut shell Ash), SBA (Sugarcane Bagasse Ash), workability, compressive strength, Split Tensile strength, Flexural strength.*

I. INTRODUCTION

Cement is a green concrete. Consumption of cement has increased dramatically year by year due to infrastructure development. When cement is widely used in concrete, the risk of environmental impact on the earth increases. The problem can be solved by replacing the cement with Sugarcane Bagasse Ash. With the use of SCBA, carbon emissions will be reduced and natural resources such as limestone will not be limited to use. Then natural remedies will be easier to work with. Annually, a minimum of 450 million tons of biomass waste is produced in India. Sugarcane residues collect 5% of the 450 million tons per year in India (Aziz & Mun, 2012).

The recycling of these products can use a variety of resources, the use of concrete industry offers one of the new solutions to the above problems. The use of various product materials such as cement reinforcement is growing from time to time. Asbestos fibre has been developed as reinforcement in cement-based concrete to increase its durability. It can also be used as a concrete mixer with the right mixture for equating heavy metals and other ash pollutants Generally, SCBA is disposed of by landfill, however, the potential danger of air particles and groundwater contamination requires well-designed and prepared waste disposal facilities, leading to high cost.

The groundnut shells were dried in the sun for three days so as to remove the water content from it and then to aid the burning process. A metallic drum with perforated holes on its body was used to burn the groundnut shells. The dried groundnut shells were placed in the metallic drum and burnt in open air in order to enhance the combustions.

A. *Sugarcane Bagasse Ash*

During sugar manufacturing, sugarcane is crushed to extract juice. The fibrous residue is called bagasse and is used as a fuel source to feed the boiler. Sugarcane bagasse ash (SCBA) is thus a residue obtained from the burning of bagasse in the sugar industry. Sugarcane is a hot and humid plant and is the largest sugar crop in the world. The acreage of sugar plants worldwide is about 31.3 million hectares, of which sugarcane accounts for about 70%. The top three sugar producing countries in the world are Brazil, India, and China, which accounted for 20.57%, 16.91%, and 6.31% of global production in 2016, respectively.

B. Groundnut Shell Ash

Groundnut shells were gathered in large quantities. The groundnut shells were dried in the sun for three days so as to remove the water content from it and then to aid the burning process. A metallic drum with perforated holes on its body was used to burn the groundnut shells. The dried groundnut shells were placed in the metallic drum and burnt in open air in order to enhance the combustion. The ash obtained in the drum was allowed to cool in the drum before removal. The ash obtained was then conditioned in a furnace at the temperature of 6500C for 180 minutes so as to reduce the carbonaceous and volatile constituents of the ash. After conditioning, sieve shaker was used to carry out particle size analysis

C. Asbestos Fibre

Asbestos is a common term referring to six types of naturally occurring mineral fibres used or commercially used. These fibres belong to two groups of minerals: serpentine and amphiboles. The serpentine group contains one type of asbestiform: chrysotile. There are five types of asbestiform amphiboles: anthophyllite asbestos, grunerite asbestos (amosite), riebeckite asbestos (crocidolite), tremolite asbestos, and actinolite asbestos. Usually, the word asbestos is used only for those types used for commercial purposes. That does not prevent the occurrence of other minerals such as asbestos, however. Asbestiform-based Magnesiorie beckite was excavated in Bolivia and an asbestiform potassium winch was found in western Texas. In addition, richterite asbestos has been compiled into a laboratory.

II. LITERATURE REVIEW

Khalil, et al (2021) reviewed Concrete is one of the most important materials used in the construction industry. Rapid depletion of natural resources, high energy consumption, and environmental degradation involved in cement production have prompted researchers to investigate other appropriate ways to apply cement partially or partially. A study conducted over the past two decades on the use of Bagasse Ash (SCBA) sugarcane as a cement for the production of concrete is summarized in this paper. First, general information about SCBA production, the effect of heat dissipation on the SCBA structure, the physical and chemical properties of SCBA and the SCBA response mechanism are briefly discussed. Subsequently, the influence of SCBA is introduced on the structures of the new state and finally, the enhanced state features namely strength and level of energy gain, durability mode, chloride ion penetration and aggressive environmental effect on SCBA concrete are introduced.

Bheel, et al (2019) researched and concluded use valuable industrial or agricultural products as the primary source of raw materials for the construction industry. These waste products save and help to create a sustainable environment and reduce pollution, called waste management. It is proposed to study that cement has been partially returned to 0%, 5%, 10%, 15% and 20% of Bagasse Ash Sugar. In this study, a total of 60 concrete samples (30 cubes and 30 cylinders) were made with a water / cement ratio of 0.5 and a 1: 1: 2 ratio of concrete mix was cured after 7 and 28 days. The main objective of this study was to look at the indirect strength and compressive strength of concrete combined with different concentrations of sugarcane ash bagasse ash. In this experimental activity, daily curing 03 cubes and 03 cylinders were discarded and finally taken as the third normal number as a final result. The result showed that the indirect stiffness and compression strength of 10% SCBA increased by 15.40% and 8.50% respectively in 28 days. Concrete performance is reduced by increasing the SCBA value in concrete.

Bouharoun, et al (2014) aimed to study the feasibility of using fibre-cement asbestos waste instead of standard Portland cement to produce mud. Fibre-cement particles were dipped in the mud to partially add cement, with replacement rates in quantities of 5 and 20%. The level of Cement hydration, efficiency, total deceleration, access slope and water-based mortar and mortar systems were measured compared to the control structures attached to the cement (free by fibrecement). The results showed that fibre-cement availability increased 5-10% of the remaining binder hydration time, compared to that of Portland cement, depending on the replacement rate shown. In addition, within 28 days, 5 and 20% fibre-cement replacement caused a 14-35% decrease in compressive strength, compared to the cement production of reference. This drop was greater than what was seen in the mud containing limestone filler with the same level of cement. However, the available energy was acceptable in the use of the building.

K.K. Alaneme et. al. 2014 In this paper entitled as "Experimental test composite samples were prepared by melting Zn-27Al alloy with pre-determined proportions of groundnut ash and silicon carbide as reinforcements using double stir casting. Microstructural examination, mechanical properties and corrosion behaviour were used to characterize the composites produced. The results show that hardness and ultimate tensile strength of the hybrid composites decreased with increase in GSA content. Although the % Elongation somewhat decreased with increase the GSA content, the trend was not as consistent as that of hardness and tensile strength. The fracture toughness of the hybrid composites however, increased with increase in the GSA content of the composites.

In 3.5 % NaCl solution, the composites were resistant to corrosion with some of the hybrid composite grades containing GSA exhibiting relatively superior corrosion resistance to the grades without GSA. In 0.3M H2SO4 solution,

III. MATERIALS

A. Cement

In this research project the binding materials used were Ordinary Portland Cement grade 43. The cement used was Khyber Cement, which is processed by Khyber cement private limited with its processing facilities in Jammu and Kashmir. Cement is a substance that when immersed in water exhibits compact and adhesive properties that help hold aggregates together to form a concrete weight. It is also known as compression cement, as it finds its place to adhere to the complex hydration process that makes the water resistant.

B. Coarse Aggregates

Materials with particle size such as those stored in the U.S. Sieve No. 480 (4.75mm) is called coarse aggregates. Coarse aggregates, like fine aggregates, must contain solid sound particles to make the concrete strong and weatherproof. It should be free chemicals or cover or clay or any other good material that can affect the binding of cement. The size of the collection used depends on the type of work. Solid crushed stone and beads are common materials used as large collections of building concrete.

C. Fine Aggregates

The best available fine aggregate has been used in this study of research and was purchased from jammu area of Jammu and Kashmir. The material which passed through I.S. Sieve No. 480 (4.75mm) is termed as fine aggregates. Function of fine aggregates is to make concrete dense, by filling voids of coarse aggregates, reduces the shrinkage of cement and makes an economical mix. Natural sand or crushed stone dust is used as a fine aggregate in concrete mix.

D. Sugarcane Bagasse Ash (SCBA)

During sugar manufacturing, sugarcane is crushed to extract juice. The fibrous residue is called bagasse and is used as a fuel source to feed the boiler. Sugarcane bagasse ash (SCBA) is thus a residue obtained from the burning of bagasse in the sugar industry. Sugarcane is a hot and humid plant and is the largest sugar crop in the world. The acreage of sugar plants worldwide is about 31.3 million hectares, of which sugarcane accounts for about 70%. The top three sugar producing countries in the world are Brazil, India, and China, which accounted for 20.57%, 16.91%, and 6.31% of global production in 2016, respectively.

Table no. 1 Properties of SCBA

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	SO_3	LOI
59.3	4.7	3.1	10.5	1.3	-	-	0.1	19.6
65.0	4.8	0.9	3.9	-	2.0	-	0.9	10.5
65.3	6.9	3.7	4.0	1.1	2.0	0.3	-	15.3
64.2	9.1	5.5	8.2	2.9	1.4	0.9	-	4.9
78.3	8.6	3.6	2.2	1.7	3.5	0.1	-	0.4
87.4	3.6	4.9	2.7	0.7	0.5	0.2	0.1	8.3

E. Groundnut Shell Ash

Groundnut shells were gathered in large quantities. The groundnut shells were dried in the sun for three days so as to remove the water content from it and then to aid the burning process. A metallic drum with perforated holes on its body was used to burn the groundnut shells. The dried groundnut shells were placed in the metallic drum and burnt in open air in order to enhance the combustion. The ash obtained in the drum was allowed to cool in the drum before removal. The ash obtained was then conditioned in a furnace at the temperature of 6500C for 180 minutes so as to reduce the carbonaceous and volatile constituents of the ash.

Table no. 2 Properties of GSA

S.no	Elemental Oxide	GSA (% by mass)
1.	Calcium Oxide (CaO)	14.3
2.	Silicon Dioxide (SiO_2)	62.7
3.	Aluminum Oxide (Al_2O_3)	12.42
4.	Magnesium Oxide (MgO)	2.0
5.	Ferric Oxide (Fe_2O_3)	14.0
6.	Potassium Oxide (K_2O)	15.46
7.	Manganese dioxide (MnO_2)	2.0

F. Asbestos Fibre

Asbestos is a common term referring to six types of naturally occurring mineral fibres used or commercially used. These fibres belong to two groups of minerals: serpentine and amphiboles. The serpentine group contains one type of asbestiform: chrysotile. There are five types of asbestiform amphiboles: anthophyllite asbestos, grunerite asbestos (amosite), riebeckite asbestos (crocidolite), tremolite asbestos, and actinolite asbestos.

Table no. 3 Properties of ASBESTOS FIBRE

	CHRYSOTILE %	CROCIDOLITE %	AMOSITE %
SiO2	37 – 44	49 – 53	49 – 53
MgO	39 – 44	0 – 3	1 – 7
FeO	0.0 – 6.0	13 – 20	34 – 44
Fe2O3	0.1 – 5.0	17 – 20	-
Al2O3	0.2 – 1.5	17 – 20	-
H2O	12.0 – 15.0	2.5 – 4.5	2 – 5

IV. METHODOLOGY

A. Mixing Concrete

All the ingredients of concrete are mixed together however this mix should be homogenous and uniform in color and consistency. The mixing can either be done by hand or with the use of mixer.

B. Mixing Concrete

Thorough mixing of the materials is essential to produce uniform concrete. The mixing should make sure that the mass become homogeneous, uniform in consistency and colour. There are two methods adopting for mixing concrete one is hand mixing and other is machine mixing.

C. Curing

Before removing the mould, it is dried for 24 hours, and then specimens are placed in a water tank made to cure specimens. The specimens must be marked for identification so that there must not be any error. The specimens are removed from the tank and dried before putting in the testing machine. The specimens are kept in the tank for 7,14,28 days.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

D. Workability Test

It can be used in site as well as in lab. This test is not applicable for very low and very high workability concrete. It consists of a mould that is in the form of frustum having top diameter of 10cm, bottom diameter of 20cm and height of 30cm. The concrete to be tested if fitted in the mould in four layers. The each is compacted 25 times with the help of tamping rod. After the mould is completely filled it is lifted immediately in the vertically upward direction which causes the concrete to subside.

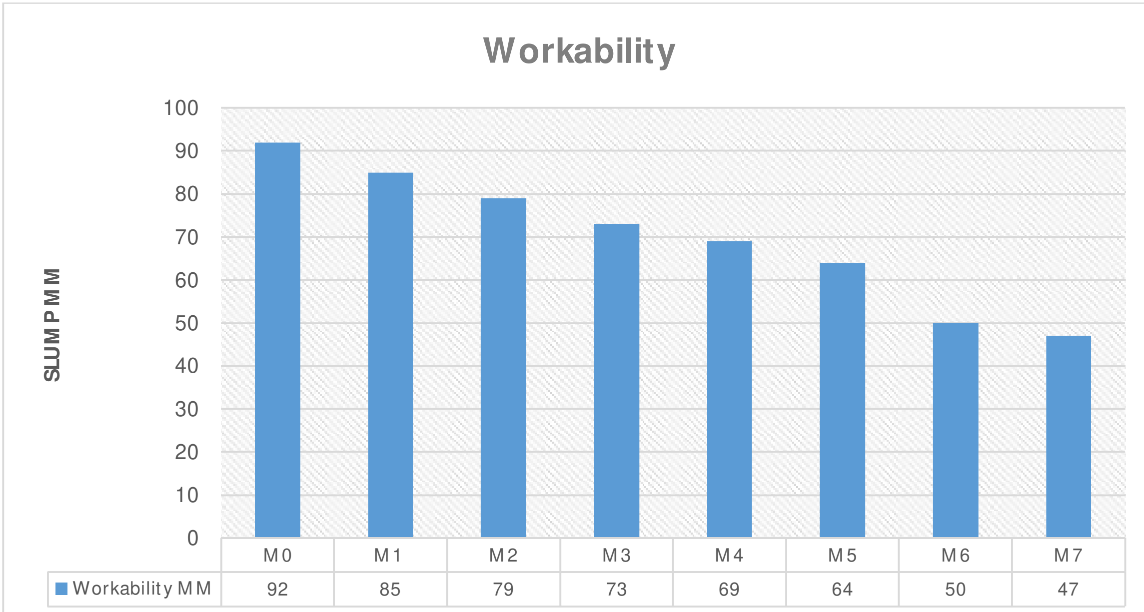


Fig -1: SLUMP CONE TEST

E. Compressive Strength Test

Then fresh concrete is filled in mould in 4 layers and after filling each layer tamping should be done 35 times in case of cube and 25 times in case of cylinder by using standard tamping rod. Once the mould is filled then leveled top surface of concrete with trowel. After the day the mould will removed and specimen are dropped in the curing tank under standard temperature of 27±2° c. After 7,14 days and 28 days in this research.

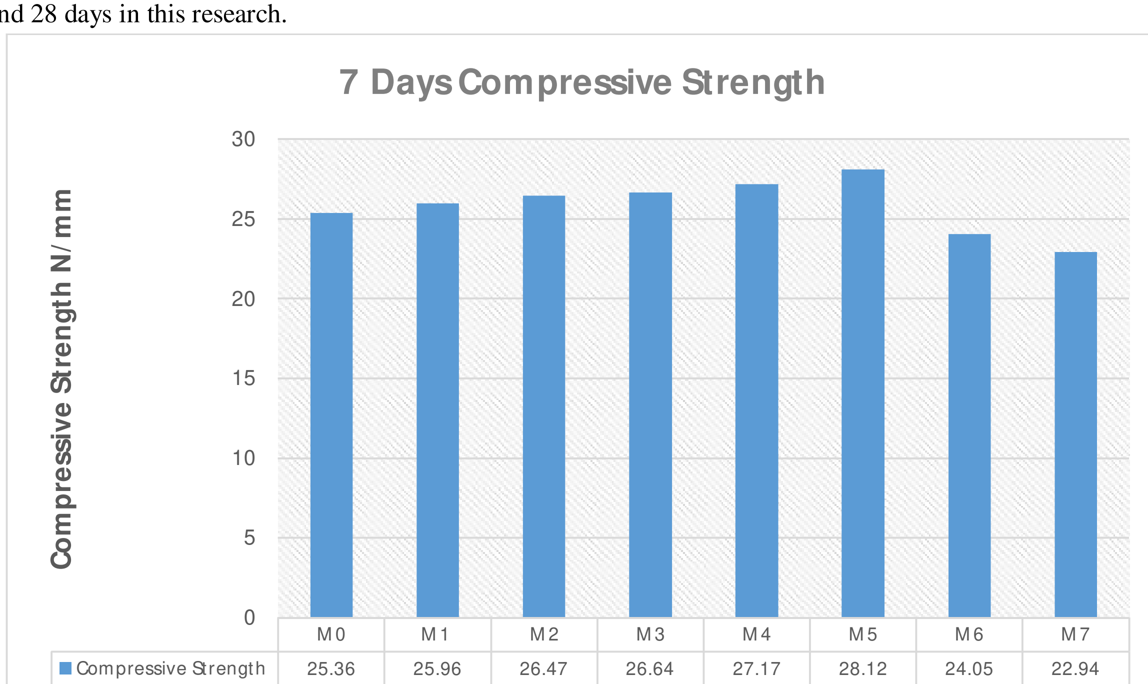


Fig -2: COMPRESSIVE STRENGTH TEST 7

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

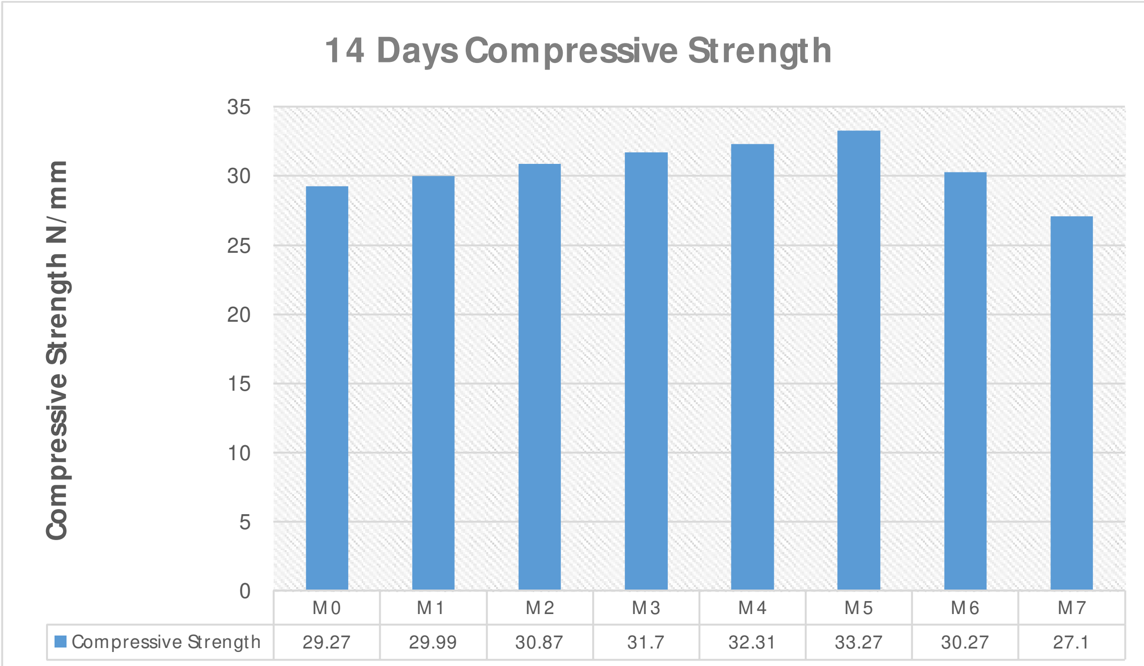


Fig -3: COMPRESSIVE STRENGTH TEST 14

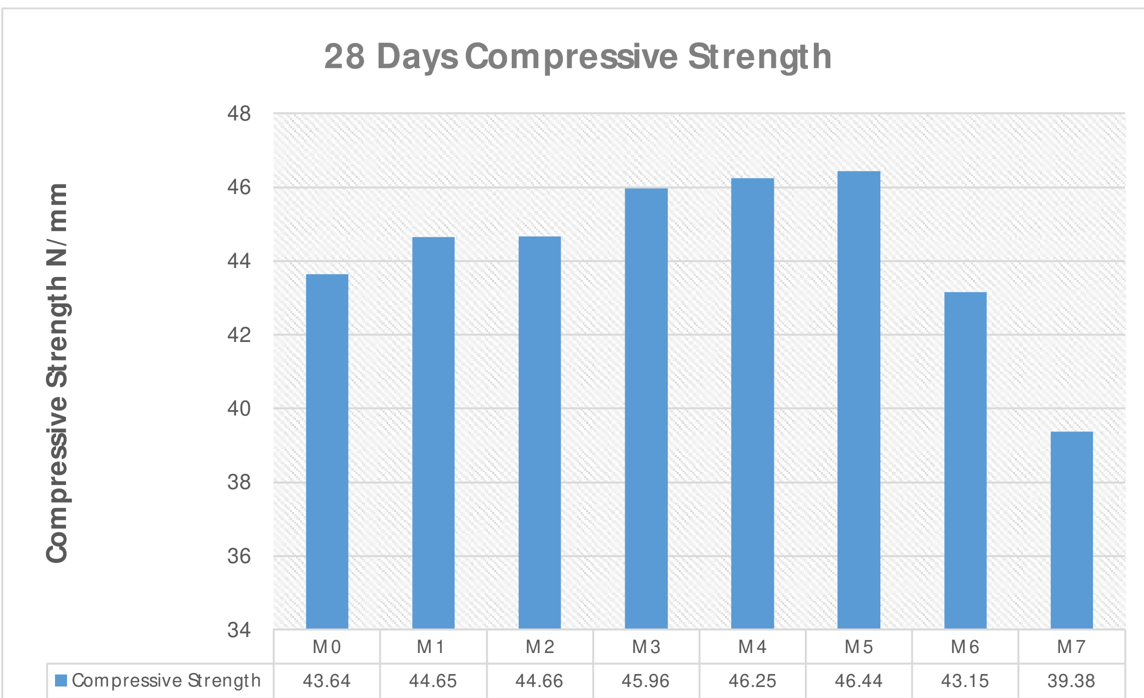


Fig -4: COMPRESSIVE STRENGTH TEST 28

F. Split Tensile Strength Test

The specimen used for this test is cylindrical and its dimension is 150 mm in diameter and 300mm in length. The instrument used for this testing is universal testing machine. The fresh concrete is prepared in according to the required grades and respective mix proportion. The fresh concrete is filled in mould in layers and each layer is tamping with standard tamping rod with 25 blows for each layer. After the day the mould is removed and specimen is placed in the curing tank for 7,14 days and 28 days in this research at the temperature 27+ 2°c. Then draw the line on the specimen.

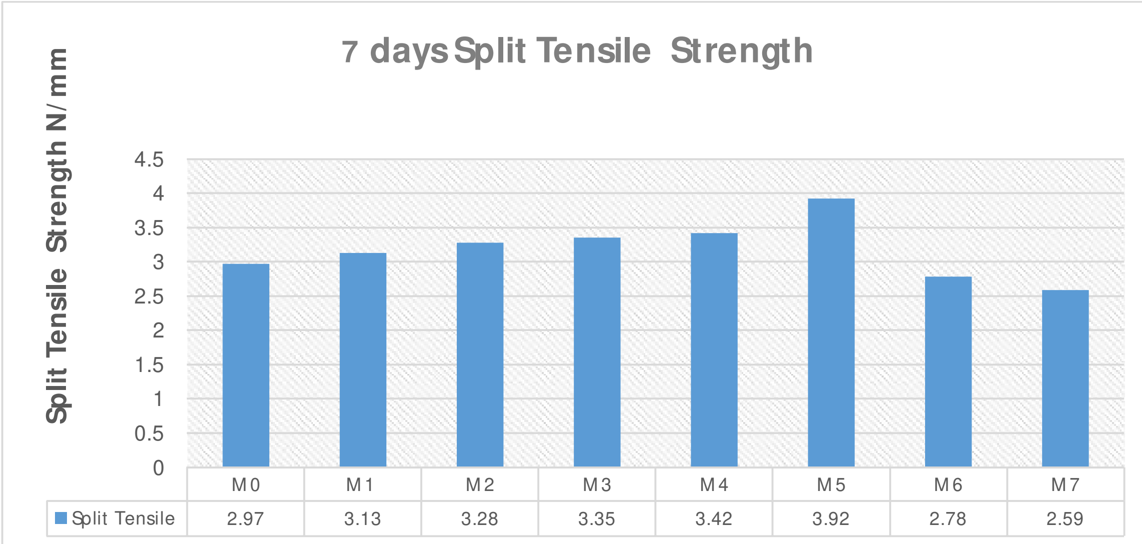


Fig -5: SPLIT TENSILE STRENGTH TEST 7

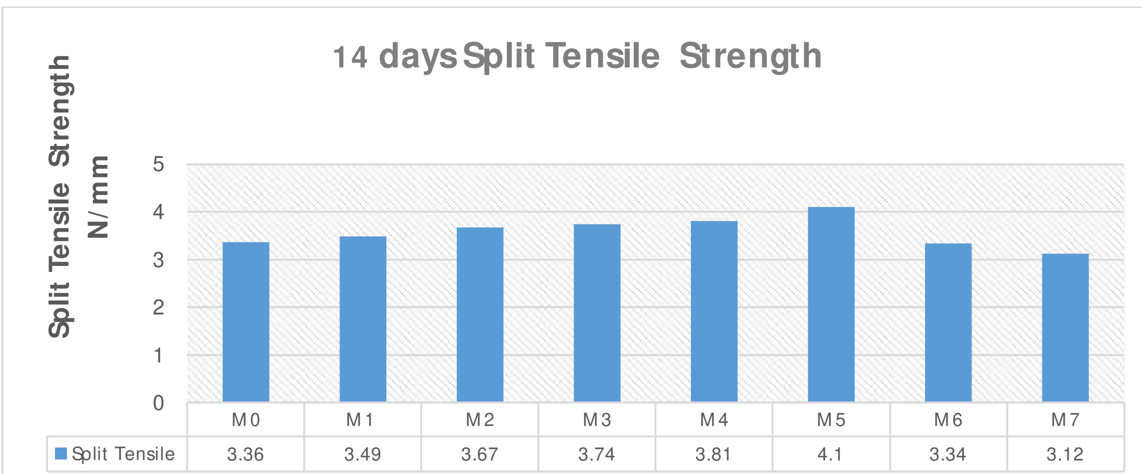


Fig -6: SPLIT TENSILE STRENGTH TEST 14

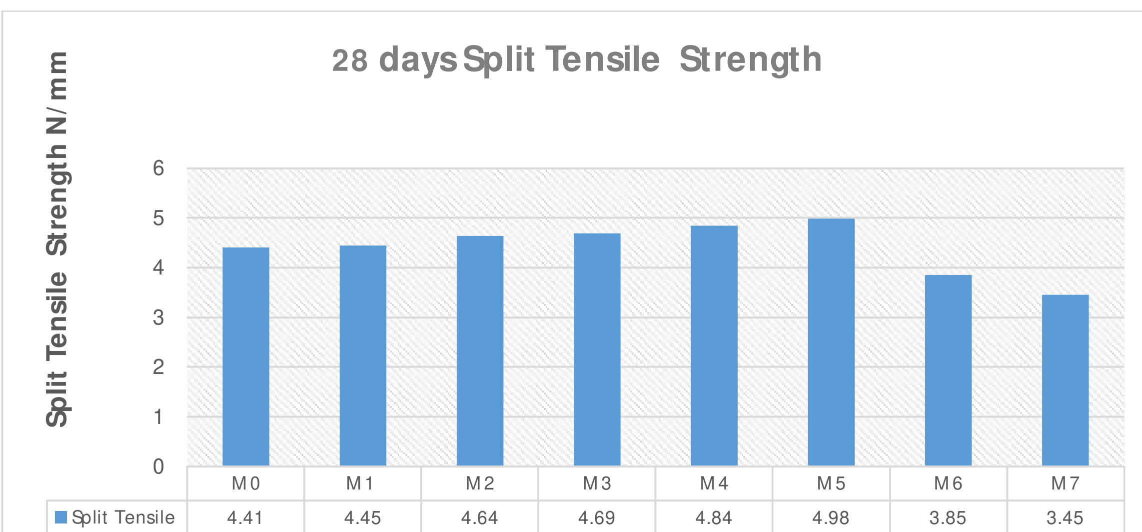


Fig -7: SPLIT TENSILE STRENGTH TEST 28

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

G. Flexural Strength Test

The concrete is prepared at required rate of mass element the mould is filled with concrete in layers and blows 25 times with standard tamping rod. After the day or we can say 24 hours the mould is removed and specimen placed in the water tank for curing at a temperature of 27 + 2 C. Depending upon the requirement the test specimen is removed from the water tank and wipe it properly for 7,14 and 28 days for testing.

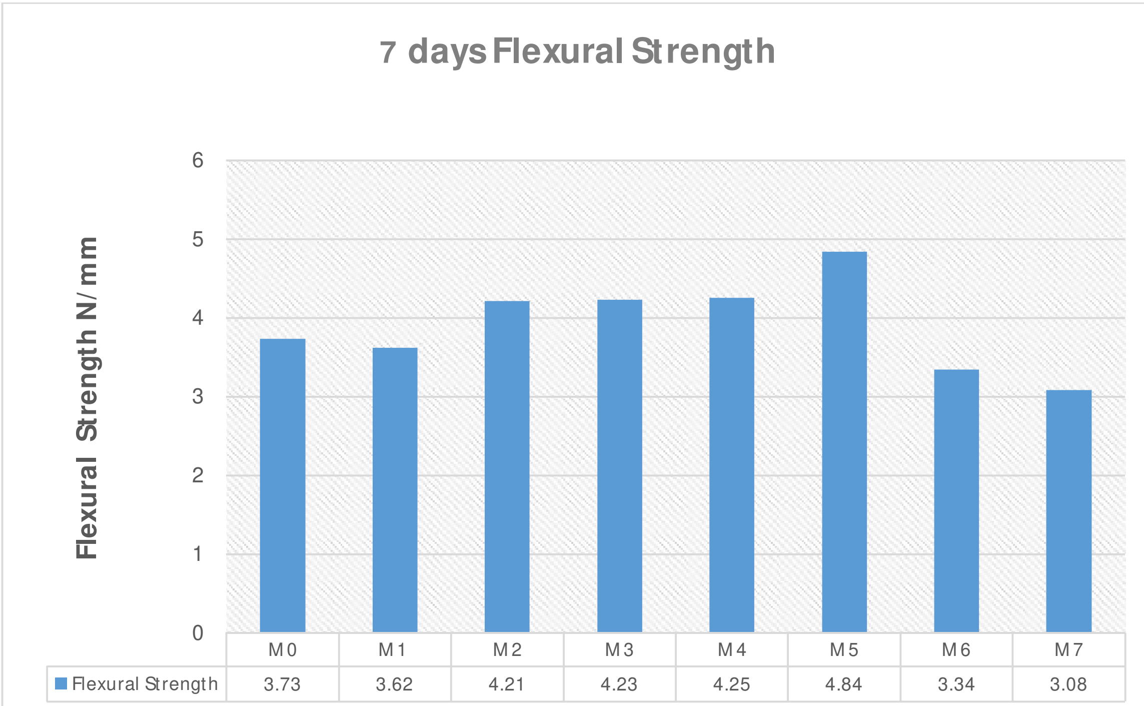


Fig -8: FLEXURAL STRENGTH TEST 7

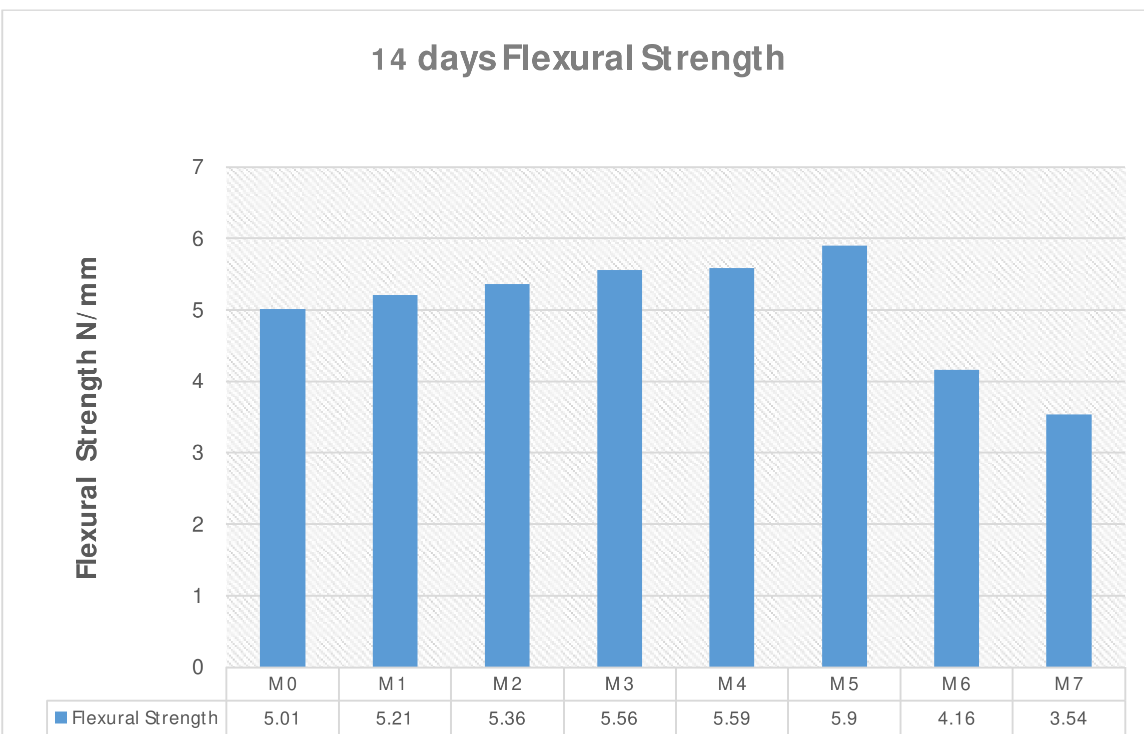


Fig -9: FLEXURAL STRENGTH TEST 14

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

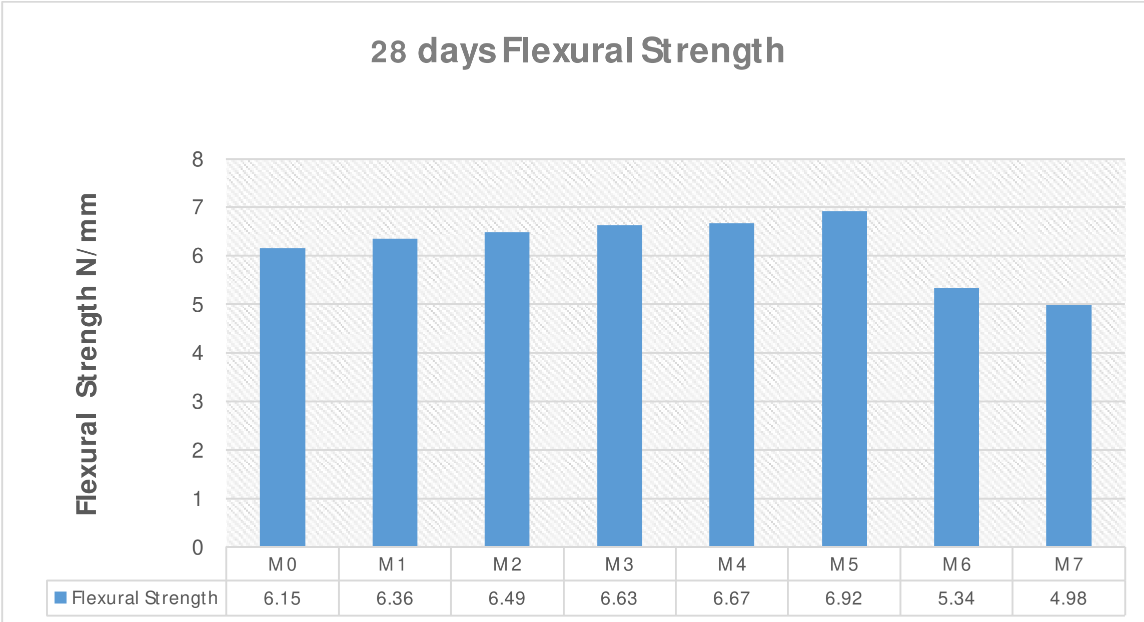


Fig -10: FLEXURAL STRENGTH TEST 28

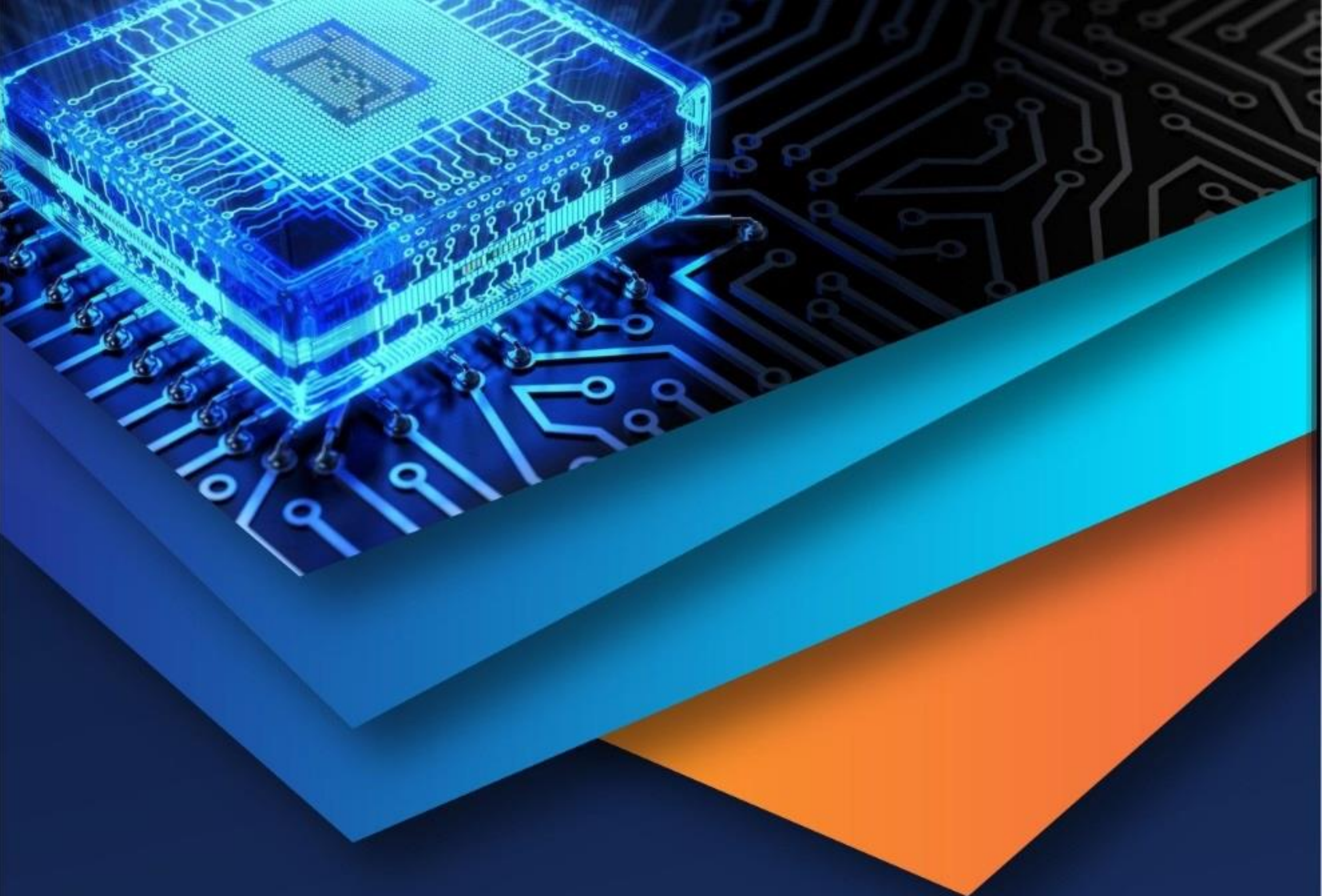
V. CONCLUSION

1) By replacing the cement with the Sugarcane Bagasse, groundnut shell Ash and with Addition of Asbestos fiber strengths get increased, also the replacement can be taken into consideration up to certain percentage workability factors gets enhanced as well.
2) The compressive strength of the concrete on comparing with conventional concrete gets increased till 12% of cement was replaced with Sugarcane Bagasse and groundnut shell Ash and for reinforcement 0.5% of asbestos fiber was used. The strength obtained at 7th day is 28.12 N/mm2.
3) After 14 days of curing, the maximum compressive strength obtained was 33.27 N/mm2 for same replacements and addition.
4) After 28 days of curing, maximum compressive strength obtained was 46.44 N/mm2.
5) In case of compressive strength, the optimum percentage that was noticed, was at 12% of replacement with Sugarcane Bagasse and groundnut shell Ash and with 0.5% of addition with asbestos fiber.
6) The flexural strength of the concrete on comparing with conventional concrete gets increased till 12% of cement was replaced with Sugarcane Bagasse and groundnut shell Ash and for reinforcement 0.5% of asbestos fiber was used. The maximum strength obtained at 7th day is 4.84 N/mm2.
7) After 14 days of curing, the maximum flexural strength obtained was 5.9 N/mm2 for same replacements and addition.
8) After 28 days of curing, maximum flexural strength obtained was 6.92 N/mm2.
9) In case of flexural strength, the optimum percentage that was noticed, was at 12% of replacement with Sugarcane Bagasse and groundnut shell Ash and with 0.5% of addition with asbestos fiber.
10) After 7 days of curing, the maximum tensile strength obtained was 3.92 N/mm2 for same replacements and addition.
11) After 14 days of curing, the maximum tensile strength obtained was 4.1 N/mm2 for same replacements and addition
12) After 28 days of curing, maximum tensile strength obtained was 4.98 N/mm2.
13) In case of tensile strength, the optimum percentage that was noticed, was at 12% of replacement with Sugarcane Bagasse and groundnut shell Ash and with 0.5% of addition with asbestos fiber.

REFERENCES

[1] R.Srinivasan (2010): "Experimental Study on Bagasse Ash in Concrete" International Journal for Service Learning in Engineering Vol. 5, No. 2, pp. 60-66, Fall 2010 ISSN 1555-9033.
[2] Faria KCP, Gurgel RF and Holanda JNF. (2010). Characterization of Sugarcane Bagasse Ash for Use in Ceramic Bodies. Materials Science Forum, 660-661, 1049-1052.
[3] Oriola, Fand Moses, G. (2010). Groundnut Shell Ash Stabilization of Black Cotton Soil. Electronic Journal of Geotechnical Engineering, 15, 415□428.

[4] Alaneme KK, Fatile BO and Borode JO. (2014). Mechanical and Corrosion Behaviour of Stir-Cast Zn-27al Alloy Matrix Composites Reinforced with Groundnut Shell Ash and Silicon Carbide. Tribology in Industry, 36(2), 195-203.
[5] Jones F. E. (1974), "Weathering Test on Asbestos Cement Roofing Material", Building Research Technical paper No. 29, H.M.S.O., London.
[6] Jothi D. (2008), "Application of Fibre Reinforcement Concrete Technique in Civil Constructions", African International MultiDisciplinary Journal, Vol-2, pp.157-172.
[7] Majumdar A. J. and Nurse R. W. (1974), "Glass Fibre Reinforcement Cement", Building Research Establishment current paper, CP79/84, England.
[8] Opoczky L. and Pentek (1975), "Investigation of the Corrosion of Asbestos Fibre in Asbestos Cement Sheets Weathered for Long Term", in A. Neville (ed.) "Fibre Reinforced Cement and Concrete", Proc. RILEM Symp., The Construction Press, England. [5] Priestley M. J. N, Seible F. and Calvi, G. M. (1996), "Seismic Design and Retrofit of Bridges," New York.
[9] Barroso J, Barreras F, Amaveda H and Lozano A 2003 On the optimization of boiler efficiency using bagasse as fuel, Fuel 82 1451–63
[10] Iskander M K 2016 Annual review status by Pakistan Sugar Mills Association Centre, Retrieved on October 20, 2016 from http://www.psmacentre.com/aboutus.php?id=6&type=annual_ review&status=1
[11] Idris M K, Eldin K and Yassin E 2015 Determination of the effects of bagasse ash on the properties of portland cement, Journal of Appl. and Industr. Sci. 3 6–11



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY