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Feasibility of Rocks of Guwahati for Construction Projects: An In-depth Study with Engineering Considerations

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Abstract: ***The study is carried out with an objective to identify different rocks found in Guwahati city which is the capital city of Assam and located on the southern bank of mighty Brahmaputra. The emphasis is also laid to extend the study to discuss and analyse the construction feasibility of these identified rocks taking into consideration the engineering and geological aspects. The field study is undertaken in Geetanagar, Guwahati Medical College hill top, Assam Engineering College hillside, Pamohi, Jorabat and Borbari which are a few prominent and geographically apart sites so that the study is conclusive and resourceful. Granite and granite gneiss is the most dominant rock type found in these areas with presence of foliation planes, joints, laminations resulting from different phases of rock formation.***
Keywords: Granite gneiss, Construction projects, Weathering, Grain size, Lamination

I. INTRODUCTION

Guwahati is the capital city of Assam which is the gateway of North East India. The city is geographically located on the banks of Brahmaputra river. The city is immensely blessed with many distinctive and special flora and fauna and is also the commercial capital of Assam. The climate is pleasant in this part of India. The seasonal changes bring to life various flora amidst its rich forest cover and it boost the tourism sector. From geological considerations, the city is mostly dominated by igneous and metamorphic rocks. The study areas chosen are Geetanagar, Guwahati Medical College hill top, Assam Engineering College hillside, Pamohi, Jorabat and Borbari. The studied areas are mostly dominated by granite and granitic gneiss. However weathered foliated gneiss is found in one of the study sites (Geetanagar) which is the outcome of metamorphism and weathering. The most prominent change pressure and temperature creates on igneous rocks is metamorphism. Most of the rocks are granitic in character which shows medium to high grade of metamorphism. They are of various shapes and sizes. For construction projects it is utmost necessary to study the rocks of the construction site which emphasize the need for site rock analysis. Rocks are natural solid substances which have numerous uses ranging from masonry work (lintels, vertical columns, covering floors of the building). They are used as blocks along the river and canal banks for preventing erosion called riprap. Rocks are used in broken or crushed form as aggregates in concrete, in road construction and also used as railway ballast. In other words it can be said that from buildings to highways rocks are an integral part of any construction projects. The studied rocks from the above mentioned sites can be used in various construction purposes like materials for building foundations. However, owing to the foliated nature, the rock found in Geetanagar site is not appropriate for construction purposes because of extreme weathered condition.

II. REVIEW OF LITERATURE

The objective of reviewing literature is to essentially frame a broad concept of the topic with a definite scientific strategy. To arrive at a conclusive study, numerous literatures of many noted researchers are studied and summarized. By this process, the familiarization with the previous knowledge and ideas that were already established by different scholars in their published papers is achieved. This further helps the readers to draw a complete notion about the information already present on a topic after analysing the strength and weakness present in the source of information. Study of different books, journals, thesis, reports, papers etc. and introduction of digital methods like e library which has wide range of e books, papers, digital journals have made the process of literature review easier and time efficient. Research papers of Masod, Md and Goswami D.N.D.,1974, Masood, Md. 1981, and Masood Md. 1982, Sarma H. D. 2018 etc. were the resource material for the present study. These papers threw light on the nature, types and compaction of the rocks in different areas of the study including petrology of pink granite and presence of granite gneiss or pre Cambrian rocks around Guwahati. The effects of climate, temperature and pressure on the rocks over the time are also found in details in these research papers which add to the resourcefulness of the present study.

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III. STUDY AREA

The area under study is located towards the southern bank of river Brahmaputra. Guwahati is an extension of the only cratonic Precambrian terrain of north east region of the Indian subcontinent i.e., the Shillong Plateau (Sarma H. D. 2018). The city is characteristically dominant of igneous and metamorphic rocks. In the present study rock types of six locations of Guwahati are thoroughly studied and their feasibility in construction projects is evaluated. The six studied locations are Geetanagar, Guwahati Medical College hill top, Assam Engineering College hillside, Pamohi, Jorabaat and Borbari.

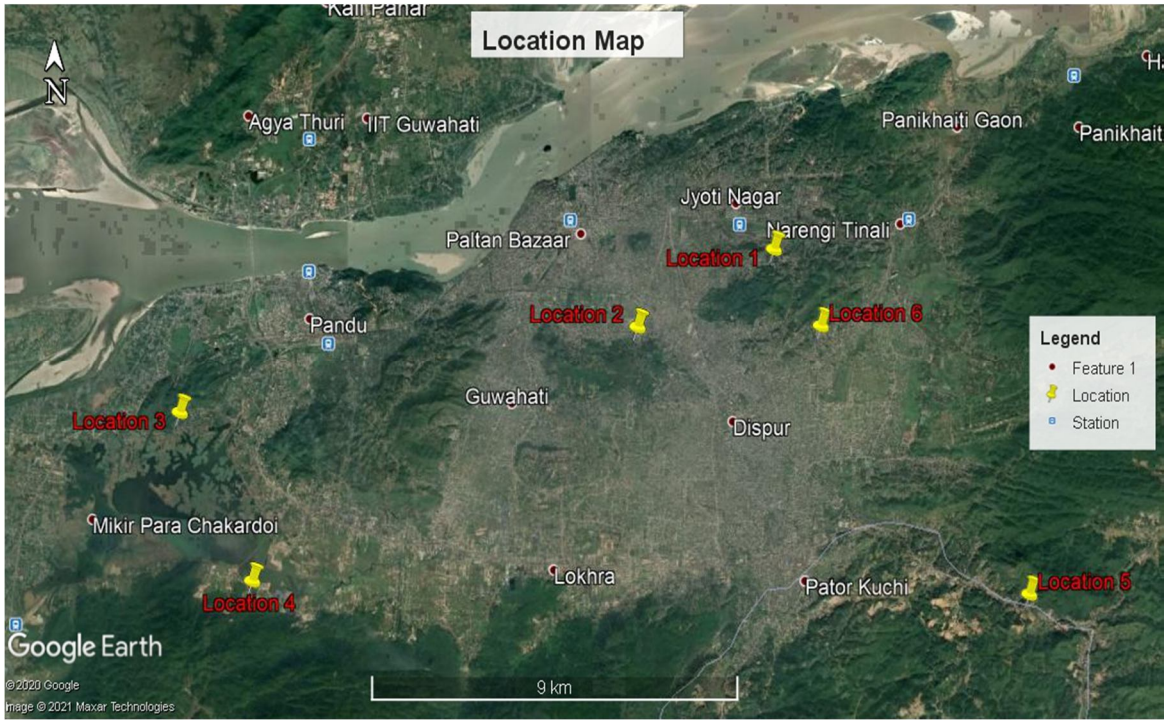

Fig.1 Location map of the study area

IV. DESCRIPTION OF THE STUDIED AREA

A. *Location 1: Geetanagar*

Location 1 is situated in the north latitude $26^0 10' 22.91''$ and east longitude $91^0 47' 59.76''$. It is near the Geetanagar Rajahuwa Shani Mandir.

B. *Location 2: Guwahati Medical College hill top*

Location 2 is situated in the Guwahati Medical College (GMC) hill top near the Public Health Engineering Department, Government of Assam. It is located in the north latitude $26^0 9' 26.07''$ and east longitude $91^0 45' 58.54''$.

C. *Location 3: Jalukbari*

Location 3 is situated in the north latitude $26^0 8' 22.73''$ and east longitude $91^0 39' 11.06''$. It is located near Assam Police Radio Organisation (APRO) Training Centre, Assam Engineering College Road.

D. *Location 4: Pamohi*

This location is situated close to the Bhima Shankar Jyotirlinga Temple. It is located in the north latitude $26^0 6' 19.59''$ and east longitude $91^0 40' 16.14''$.

E. *Location 5: Jorabat*

It is located in $26^0 6' 10.28''$ N latitude and $91^0 51' 45.87''$ E longitude, it is near Montfort school, Jorabat, Guwahati.

F. *Location 6: Borbari*

It is located near the Pratiksha Hospital, Borbari, VIP road, Guwahati and situated in the north latitude $26^0 9' 26.91''$ and east longitude $91^0 48' 41.28''$.

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V. DIFFERENT ROCK TYPES FOUND IN THE STUDY AREA

A. Rock Types of Location 1

In the present study, Geetanagar (Geetamandir hill top) is studied in depth and found that Geetamandir hill top is exclusively made up of weathered soil cover of pre-existing rock. No fresh exposed bedrock is seen near the Geetamandir area. One small exposer of weathered bedrock is observed in the present location which is near the Geetanagar Rajahuwa Shani temple (Fig. 2, 3). This exposer is a weathered rock mass of pre-existing rock of granitic origin. Grain size is medium. Weathered quartz grains are clearly visible in the weathered rock mass. Distinct foliation plane depicts high grade metamorphism in the present study area.

Fig. 2 Field photograph showing weathered granitic rock of Location 1

Fig. 3 Field photograph showing the foliations of weathered bedrock

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B. Rock Types of Location 2

The area (GMC hill top) is dominated by very coarse grained granite. Granite is composed of distinct minerals of rose (pink) quartz, mica and feldspar with gradational contact (Fig. 4). Granite of this area is rugged/sharp with distinct development of joints (Fig. 5). Two mutually perpendicular sets of joint are clearly observed in the present study area.

Fig. 4 Field photographs showing coarse grained granite

Fig. 5 Field photograph showing prominent joints of granite

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C. Rock Types of Location 3

The study area is dominated by coarse grained granite. Massive granite present in the study area is very rugged or sharp, showing no weathering (Fig.7). Minerals present in granite are very coarse grained rose (pink) quartz, mica and feldspar with sharp contact with each other (Fig. 6). One set of less prominent joint is also observed in the study area. Very sharp contact of minerals of granite indicates very low or no metamorphic effect.

Fig. 6 Field photograph showing coarse grained granite

Fig. 7 Field photograph showing one set of less prominent joint in massive granite

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D. Rock types of Location 4

The rock types of Pamohi area include foliated granite gneiss (Sarma H. D. 2018). During field study it is seen that the Pamohi area is dominated by medium grained granite and medium grained granite gneiss. Medium grained granites are composed of mostly medium grained quartz with occasional presence of very large sized biotite (mica) (Fig. 8). The topography is dominated by rugged granites showing no weathering and with three sets of joints.

Fig. 8 Field photograph showing coarse grained minerals of biotite

Fig. 9 Field photograph showing three sets of joints in granite

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E. Rock Types of Location 5

This study area is dominated by massive laminated granite gneiss. Granite gneiss is showing thick quartz bands. The granite gneiss is medium grained and is showing high mica content.

Fig. 10 Field photograph showing quartz laminations

F. Rock Types of Location 6

The Borbari area is dominated by medium grained granites where thin alternate bands/laminations of mica and quartz are very prominent (Fig. 11). Granites are sharp and medium grained. Presence of weathered granites is also observed in the area.

Fig. 11 Field photograph showing alternate bands of quartz and mica laminations

VI. FEASIBILITY OF REPORTED ROCKS IN CONSTRUCTION PROJECTS

From the above study it is clear that the six locations are dominated by granitic rocks. Both coarse grained (GMC hill top, Jalukbari) and medium grained (Geetanagar, Jorabaat, Borbari) granites are reported from the studied locations. Granites reported from the studied locations are characterised by prominent jointing (GMC hill top, Jalukbari, Pamohi), laminations (Jorabaat, Borbari) and foliation planes (Geetanagar). These properties play an important role in construction projects. Besides these, the constituent minerals of a rock type also play major significant role when it is used as a building material.

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A. Granite and Gneiss as a Building Material

Granite is a most common igneous rock which is very hard, crystalline, durable and available in different colours and can be polished to smooth surfaces. Apart from these properties resistance of granite is also very high. It is used in construction purposes for its high crushing strength and very low porosity. In the present study very hard, rugged, fresh granites are reported from GMC hill top, Jalukbari, Pamohi, Jorabaat area. These granites are crystalline, durable and are found in varied colours which can be polished efficiently. Crystalline property always decreases porosity of a rock mass. Hence granites of this studied area can be used in different construction projects. On the other hand granite gneiss is a metamorphic rock which splits into thin slabs along its foliation planes. In the Geetanagar area the studied bedrock is a weathered, deeply foliated rock mass which depicts its unsuitability to any construction purpose.

B. Rugged/sharp Granites vs. Weathered Granite gneiss as a Building Material

In general hard/rugged rocks are the best foundation sites for any construction projects. In some instances a highly weathered, foliated hard rock foundation is weaker than consolidated sedimentary rocks. In this case stability depends on degree of weathering. In such condition (Geetanagar, location 1) it is necessary to interpret the depth of weathered zone through various geophysical methods or test drilling at selected sites in the region.

C. Practicality of Grain size in Construction Projects

It is well known that fine grained rocks are generally more dense and stronger than coarse grained rocks. It is seen that grains are very coarse in GMC hill top and Jalukbari area and in the other locations grains are medium in size. From this point of view it can be said that granites of Pamohi, Jorabaat and Borbari area is more strong than the others.

VII. ROCK DEFECTS REPORTED FROM THE STUDIED LOCATIONS AND THEIR FEASIBILITY IN CONSTRUCTION PROJECTS

According to lithological studies, rocks are placed in any of these three classes based on their origin. They are igneous, metamorphic and sedimentary. But massive rocks belonging to any one of these classes are capable of supporting huge amount of load and impervious to the desired extent, provided they do not contain any joints, shear zones, fractures and other planes of weakness.

In the present study granite reported from the Jalukbari area shows comparatively massive character, though one set of weak joint is observed in the area. On the other hand, granite found in GMC hill top shows two distinct sets of joints which are mutually perpendicular to each other. Three sets of joints are observed in the Pamohi area granites. These joints are weak planes which can induce slippage and can act as pathways of leakage of water. Slippage of rocks along these fractures and leakage of water are considered problematic and so are not desirable in construction projects. Apart from these joints, the granites of Jorabaat and Borbari area show distinct alternate layers of laminations. With time, these laminations can act as possible planes of weakness.

The worst rock condition is observed in the Geetanagar area (near Geetanagar rajahuwa shani temple) which are badly weathered and foliated. Foliation planes are again some weak planes that develop in metamorphic rocks as a result of metamorphism. They also serve as pathways of leakage of water and slippage of rocks along the planes.

VIII. CONSTITUENT MINERAL GRAINS AND THEIR ROLE IN CONSTRUCTION PROJECTS

Rocks are made up of different types of minerals. If the constituent minerals are hard, free from cleavage and resistant to weathering, the rock is likely to be strong and durable. The weathered rock type of the first location (Geetanagar) shows very high amount of quartz as a constituent mineral grain. Quartz is a crystallised form of silica. It shows highest resistance to weathering. Due to this property quartz is still in crystallised form in the study area. Other minerals cannot be identified as they decayed due to low resistance to weathering. It is known to all that quartz has highest resistance to weathering. Due to this property rock containing high amount of quartz acts as a very good building stone. In the study area quartz acts as a dominant mineral. However size of quartz grains is different in each location. Therefore it can be said that the granites found in Guwahati are very good building stones in construction projects due to their high quartz concentration.

IX. CONCLUSION

The study of different rocks found around Guwahati and its practical use in construction projects is the main theme of the field work. Six locations namely Geetanagar, GMC Hill Top, Jorabat, Pamohi, Borbari were selected and field study was done. It was found from the location of GMC Hill Top and Jalukbari that mostly rocks were coarse grained granites. Again from the location of Geetanagar, Borbari and Jorabat, the rocks composed of medium grained granites.

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Some of the locations were characterised by prominent jointing whereas some have laminations and foliation planes. The Geetanagar location possessed weathered soil cover of pre-existing rock. Quartz was found in the site due to its highly resistive nature but lacks the ability in construction planning. The GMC Hilltop was dominated by coarse grained granite composed of pinkish quartz, mica and feldspar. These include jointing which were not suitable as these create leakage in the rocks. The Jalukbari location was dominated by coarse grained granite and the area seemed to be rugged and the minerals present in granites have sharp contact with each other which provide advantage in construction purposes. The Pamohi location was dominated by medium grained granites and gneiss. These include medium grain quartz grains and very large biotite crystals. From the locations of Borbari and Jorabat the nature of rocks found were mostly massive granite gneiss and medium grained granites but include thick quartz bands and laminations of mica which again creates problems in the compactness of the nature of the rocks.

So it can be summarised from all the findings that the location of Jalukbari has a better prospect among others due to its rugged nature and minerals present in granite have sharp contact which provide more compactness in its nature and therefore desirable for use in construction projects. Among the locations studied, Geetanagar does not hold promising prospects in the construction of building stone or foundation stone due to weathering. Apart from Geetanagar location, other locations can be used for building stone without much modification and precaution. But for the foundation stone the rocks need to be modified to certain extent in order to make them fully compatible for construction by sealing the joints with appropriate engineering methods.

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REFERENCES

[1] Masood, Md 1977: petrology of the pink granite around Guwahati,Assam,jour. Assam Sci Soc,20A,pp-72.
[2] Masood, Md and Goswami D.N.D.,1974: basic rock from the Pre cambrain terrain around GuwahatiIndian Mineralogist,vol. 15.p-55-62.
[3] Masood, Md. 1981: Granite genisses around Guwahati Assam ,Quart .jour.Geol Tech.Rept.11,pp.102.
[4] Masood Md. 1982: Structural Historical of the pre -cambrain rocks around Guwahati , Assam,Quart, jour. Geol. Mineral Met. Soc. India, Vol 54, No 1,2, pp 33,38.
[5] Sarma, H. D. 2018: “Granitization of the Gneissic Rocks in the Rani - Pamohi Area, Kamrup Metro, Assam, India.” 6(1):13.

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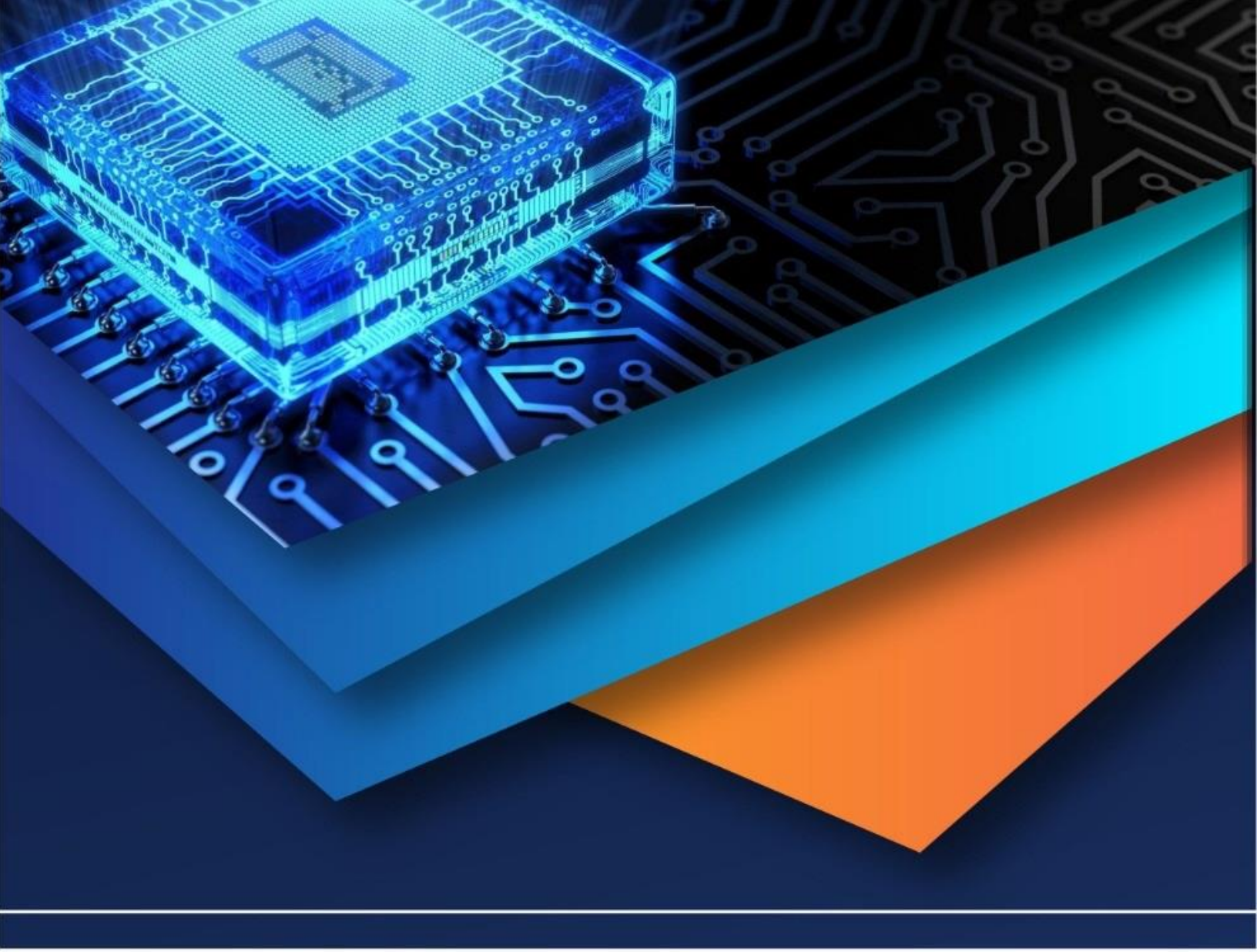

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