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Assessment of Groundwater Qualityin Gorakhpur City for Drinking Purpose

Guru Gyan Singh[1], Dr. Anirudh Gupta[2]
[1]*M.Tech Scholar, Civil Engineering Department, Institute of Engineering and Technology, Lucknow, India*
[2]*Assistant Professor, Civil Engineering Department, Institute of Engineering and Technology, Lucknow, India*

Abstract: Groundwater is one of the major resources of the drinking water in Gorakhpur city. In this study ten parameters were selected pH, turbidity, iron, total hardness nitrate, chloride, total dissolved solids, sulphate, arsenic and alkalinity for water quality of samples from different sampling stations. The work was carried out during different months such as January, February, March, April and May. The analysis shows that the studied sample's parameters, including pH, turbidity, total hardness, TDS alkalinity, iron, sulphate, and nitrate concentration, are within the allowable range according to drinking water standards. Additionally, it was discovered that there was relatively little fluctuation in the parameter's mean values across samples, in contrast to the higher variation observed across months.
Keywords: Drinking water, groundwater, Monthly Variational, TDS, Iron, Sulphate.

I. INTRODUCTION

Water could be a priceless gift from nature to all or any living organisms in need of sustenance. The subsurface and surface water are mostly accountable for the reasonableness of water for agricultural, industrial, and domestic needs. With the exception of glacial masses and polar icecaps, groundwater is that the world's largest source of H2O. Of some states in India, 90 percent of individuals depend upon groundwater for home, drinking, rural, and industrial needs. the character of groundwater is influenced by variety of things like discharge of rural, industrial, and domestic fluids, land use plans, topographical development, precipitation example, and infiltration rate. After reviewing the numerous research papers on this area, I found that assessment of seasonal variation of groundwater for drinking purposes. Thus, during this research paper i've got analyzed the monthly variation of groundwater for drinking purposes at Gorakhpur city. because of unanticipated population expansion, urbanization, technological improvement, and better standards of life, developed countries have experienced increased water demand in both the agricultural and industrial sectors. Only 0.16 percent of the water on Earth is acceptable for individual use, while the remaining 95 percent is contaminated for a range of ecological reasons (JHARIYA et al., 2018). The provision of an appropriate supply of drinking water while maintaining a standard water quality has become a serious concern as a result of the increasing demand for water around the world (Mekonnen & Hoekstra, 2016). One-third of the world's population relies on groundwater (also known as "groundwater") as one of the purest sources of water since it is the most dependable and vast repository of freshwater on Earth (Foster & Chilton, 2003). Despite the importance of groundwater, it is not properly maintained in terms of quality. The most important elements that directly and indirectly influence the quality and quantity of Groundwater are a variety of pollution sources, climate changes, groundwater recharge, subsurface geochemical reactions, surface water characteristics, geographic locations, atmospheric precipitation, and human activities (Kumar et al., 2014). Furthermore, one of the main factors contributing to the decline in groundwater quality is the infiltration of saline water into the coastal region (Kim et al., 2006). Horton initially proposed and developed the estimation of WQI as one of the most useful methods for assessing water quality. WQI is often calculated to evaluate the water quality primarily based on its appropriateness for drinking. As a result, it has developed into a useful instrument for managing groundwater quality and ensuring the use of pure drinking water (Tiwari et al., 2014) . Since this technology is so effective at reducing large amounts of complex data to a single number, this process aids in the stable expression of water quality. As a result, for management and decision-making reasons, the values generated from WQI can be considered to be much more accessible and simply understandable for researchers, public audiences, concerned citizens, as well as national water regulators. Although there are various methods for calculating WQI, each one takes into account the same physical and chemical characteristics of water; the only differences between the methods are in the data integration and result interpretation processes (Saeedi et al., 2009) . Salinity in groundwater has emerged as a major issue in India's North-East coastline region, particularly in Gorakhpur City, which is situated on the RAPTI river.

A. *Study Area*

The present study was dole out at Gorakhpur could be a city settled on the banks of RAPTI River. populated area of Gorakhpur is 144km2 approx. Data over the past 100 years show a substantial increase within the intensity and frequency of floods, with extreme events occurring every three to four years. Generally, 20% of the population is influenced by floods, which are a yearly event in a very few zones, causing enormous cost, health and occupations for the poor occupants, yet as harm to personal and holding. a big economic and industrial hub of eastern Uttar Pradesh, Gorakhpur is found within the country's northeast at latitudes 26.7322 to 26.7828 and longitudes 83.3378 to 83.3613.

II. MATERIALS & METHODOLOGY

For sample collection, different shallow depth and India Mark-II hand pumps located in the Gorakhpur District were chosen. For physico-chemical examination, the materials were collected in sterilized one-liter plastic bottles. The samples were taken from India Mark-II hand pumps placed by government organizations as well as shallow depth hand pumps installed by locals for drinking water. The samples were examined in accordance with the established protocols. All samples came from those locations where drinking-quality ground water was being extracted. Twenty-five samples were taken from India Mark-II hand pumps and the remaining twenty-five from shallow depth hand pumps at ten different locations (Verma et al., 2013).

Table 1 Parameters of water with their permissible limits of drinking water, recommended agency and unit weights.

S. No.	Parameters	Standard Values	Recommended Agency	Unit Weight
1.	pH	6.5-8.5	BIS:10500 :2012	0.001135
2	Turbidity	5 NTU	BIS:10500 :2012	0.001929
3	Iron	0.3 mg/l	BIS:10500 :2012	0.032
4	Sulphate	200mg/l	BIS:10500 :2012	0.00004822
5	TDS	500mg/l	BIS:10500 :2012	0.00001929
6	TH	200mg/l	BIS:10500 :2012	0.00004822
7	Alkalinity	200mg/l	BIS:10500 :2012	0.00004822
8	Chloride	250mg/l	BIS:10500 :2012	0.00003858
9	Nitrate	45mg/l	BIS:10500 :2012	0.0002143
10	Arsenic	0.01mg/l	BIS:10500 :2012	0.964

A. *Laboratory Evaluation*

In order to evaluate the water quality, 50 samples from shallow deep hand pumps were collected from ten locations in the Gorakhpur city. These samples are bring to ecomen Laboratories Pvt. ltd. Lucknow and were tested for pH, Alkalinity, Total hardness, TDS, Turbidity, Iron, Chloride, Sulphate, Nitrate, and Arsenic. The analysis of the samples was carried out in accordance with the standard procedure

III. RESULT AND DISCUSSION

Table 2 Monthly variation of the physicochemical parameters of the waterbody.

S. No.	Parameters	January	February	March	April	May
1	pH	7.035	6.9	7.13	7.9	7.1
2	Turbidity (NTU)	39.02	35.46	35.37	55.45	50.57
3	Iron (mg/l)	1.474	1.47	1.66	1.94	1.77
4	Sulphate (mg/l)	46.97	49.91	41.8	43.49	41.57
5	TDS (mg/l)	215.5	193.5	196.05	203.9	195.7
6	TH (mg/l)	278	267.54	268.36	276.8	270.63
7	Alkalinity (mg/l)	101.7	98.18	99	103.5	102.4
8	Chloride (mg/l)	81.66	76.4	76.25	84.18	86.66
9	Nitrate (mg/l)	9.377	8.11	8.17	9.04	8.12
10	Arsenic (mg/l)	0	0	0	0	0

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The evaluation of the test results of the physico-chemical properties of groundwater samples from India Mark-II and shallow depth hand-pumps is done with consideration to IS:3025.

Table 2 presents the results of the physicochemical parameter analysis along with data for variable means and a graphical representation of the special and temporal variation.

The concentration of hydrogen ions in water determines whether it is acidic or basic. The current investigation clearly showed that the pH within the IS:3025 limit recorded varies from 6.78 to 7.49 January, 6.8 to 7.39 for the February, 6.9 to 7.41 for the March, 6.8 to 7.45 for the April and 6.6 to 7.45 for the May Lower pH values can lead to tuberculation and rust, whereas higher pH values can result in incrustation, residue deposits, and trouble chlorinating water to disinfect it. The World Health Organization has also advised that drinking water should have a pH of 6.5 or above to prevent corrosion. pH values between 6.5 to 8.5 is indicate good water quality.

Water turbidity is the clearness of water and as there are chemicals in suspended form present. Recorded turbidity average values 1.94 in January , 1.87 in February, 1.68 in March, 2.125 in April and 1.69 in May Turbidity variation are shown in figure 2.The maximum values of turbidity are found due to heavy rain in the month of April. The effect of rain inorganic and geological issues raises into the groundwater.

The Maximum turbidity values are found due to the shallow in the low ground level hand pump.

Salinity of the waters is defined by present are TDS in water. TDS value of all samples lie within permissible limit (drinking water). The increase in TDS is caused by enhanced seepage of rain water. TH values of groundwater samples comes within permissible limit (drinking water).

TH of samples increased during April and May months due to high rate of evapotranspiration and during January month it increase due to high rate of percolation.

All the values of the Chloride are within permissible limit (drinking water). High value of Chloride's content in groundwater samples may be result of anthropogenic or natural sources or both them like septic tank wastes, run-off containing salts and animal feeds.

The results of the Nitrate there is almost no unusual changes in nitrate of water samples. All the values of the Iron, Sulphate and Alkalinity are with in permissible limits in water. Iron is no abnormal change in iron value of groundwater samples. There are almost no unusual changes in sulphates of groundwater samples. There is no abnormal change in alkalinity of water samples, but average alkalinity increases with increase in anthropogenic activities There is no trace of arsenic in any of the samples during all five months.

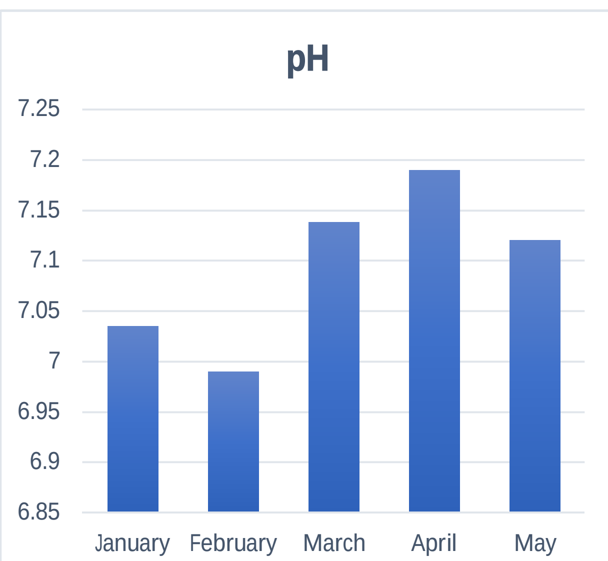
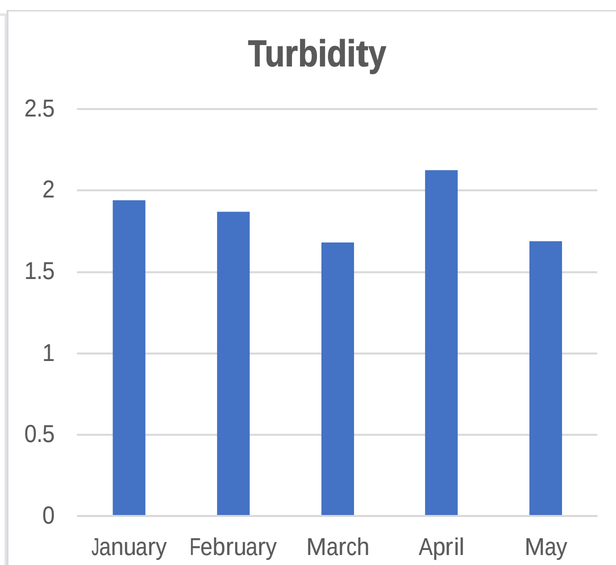


Fig-a



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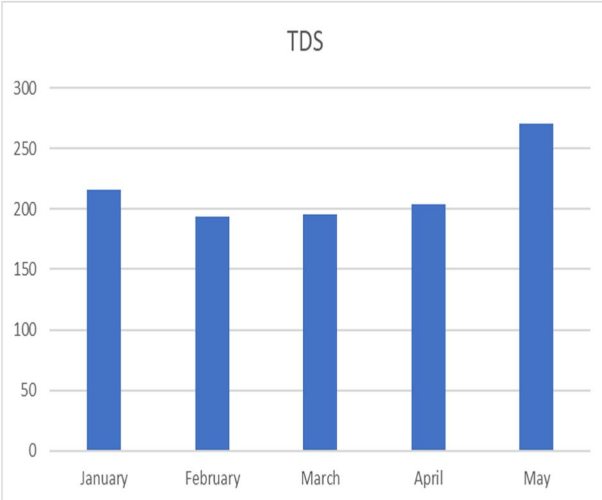
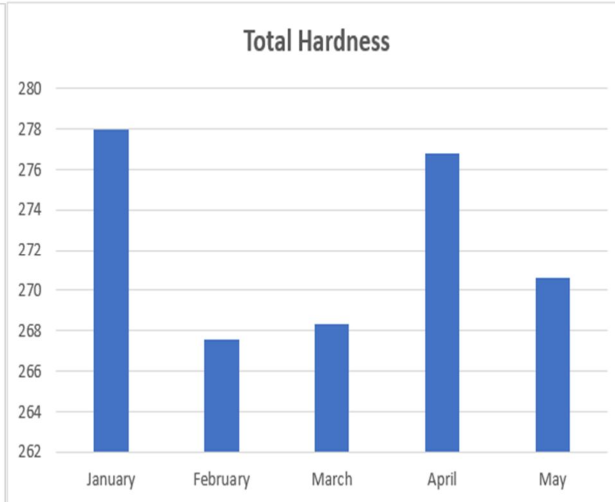


Fig -c



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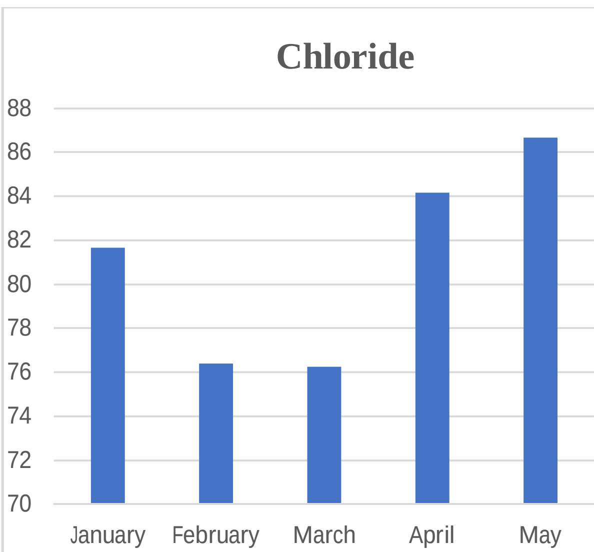

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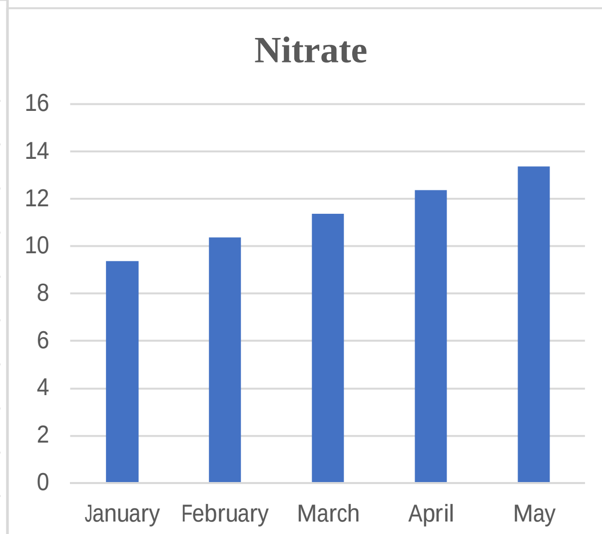

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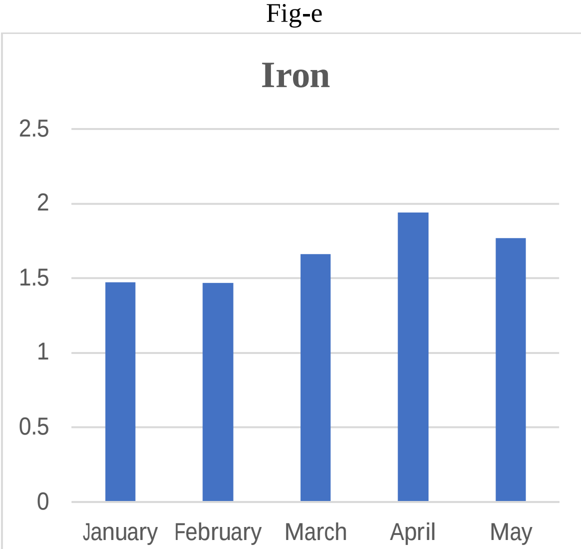
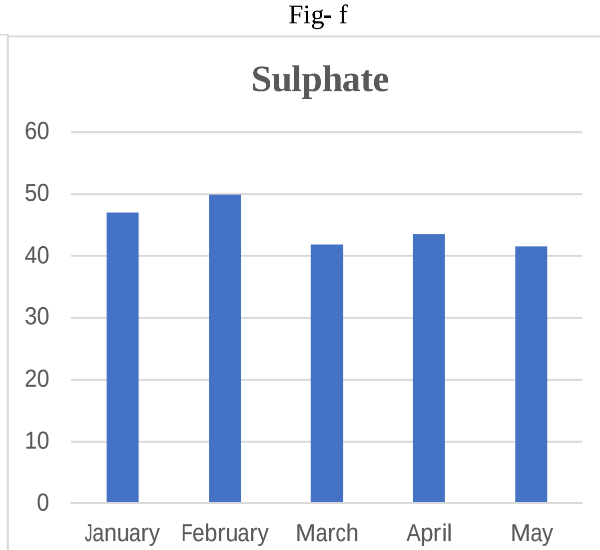


Fig-g



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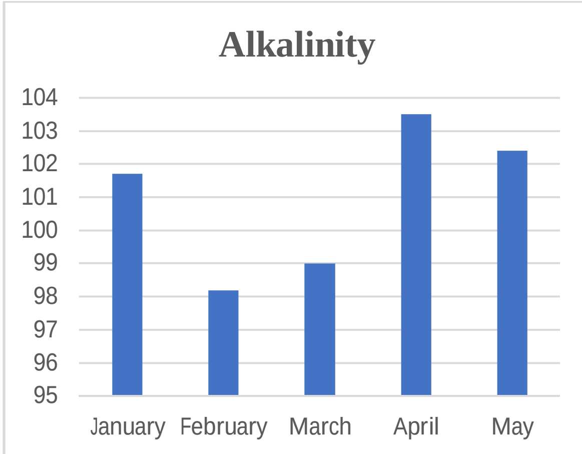

Fig-i

Monthly variation of various parameters of groundwater. (a) pH, (b) turbidity, (c) TDS, (d) Total hardness, (e) chloride, (f) nitrate, (g) iron, (h) Sulphate, (I) Alkalinity.

IV. CONCLUSION

The testing of groundwater in the Gorakhpur City are tested in this research work. The sample for testing the ground water are taken from 25 India Mark II and 25 samples from shallow deep Handpump between the month of January to May. After the measuring the all samples the water is suitable for drinking according to limitation and the methods which are used that is IS:3025 for testing the pH, turbidity, TDS, Total Hardness, chloride, Nitrate, Iron, Sulphate, Arsenic and Alkalinity. After the testing of the result it was the water is suitable for drinking. The results of all testing parameters are shown below

1) The limitation of pH between 6.5 to 8.5 according to the BIS:10500:2012 is good for drinking water. The results were found after testing are the permissible limit for drinking purposes.
2) The standard value of Turbidity is 5NTU is good for drinking water. The results were found in the month of January, February, March, April and May is 1.94, 1.87, 1.68, 2.125 and 1.69 respectively which are under the permissible limit.
3) The standard value of TDS is 500mg/l is good for drinking water. The results were found in the month of January, February, March, April and May is 215.5,193.5, 196.05, 203.9 and 195.7 respectively which are under this standard value.
4) The permissible limits of Total Hardness (200-600 mg/l) good for drinking water. The results were found in the months of January, February, March, April and May is 278,267.54, 268.36,276.8 and 270.63 respectively which are under the permissible limit.
5) The standard value of Chloride is 250 mg/l is good for drinking water. The results were found in the months of January, February, March April and May is 81.66, 76.4, 76.25, 84.18 and 86.66 respectively which are under the permissible limit.
6) The standard value of Nitrate is 45 mg/l is good for the drinking water. The results were found in the months of January, February, March, April and May is 9.37, 8.11, 8.17, 9.04 and 8.12 respectively which are under the limit.
7) The standard value of the sulphate is 200 mg/l is good for the drinking water. The results were found in the months of January, February, March, April and May is 46.97, 49.91, 41.8, 43.49 and 41.57 respectively which are under the permissible limit.
8) The permissible limit of the Alkalinity is 200-600 mg/l is good for the drinking water. The results were found in the month of January, February, March, April and May is 101.7, 98.18, 99, 103.5 and 102.4 respectively which are under the permissible limit.

V. ACKNOWLEDGMENT

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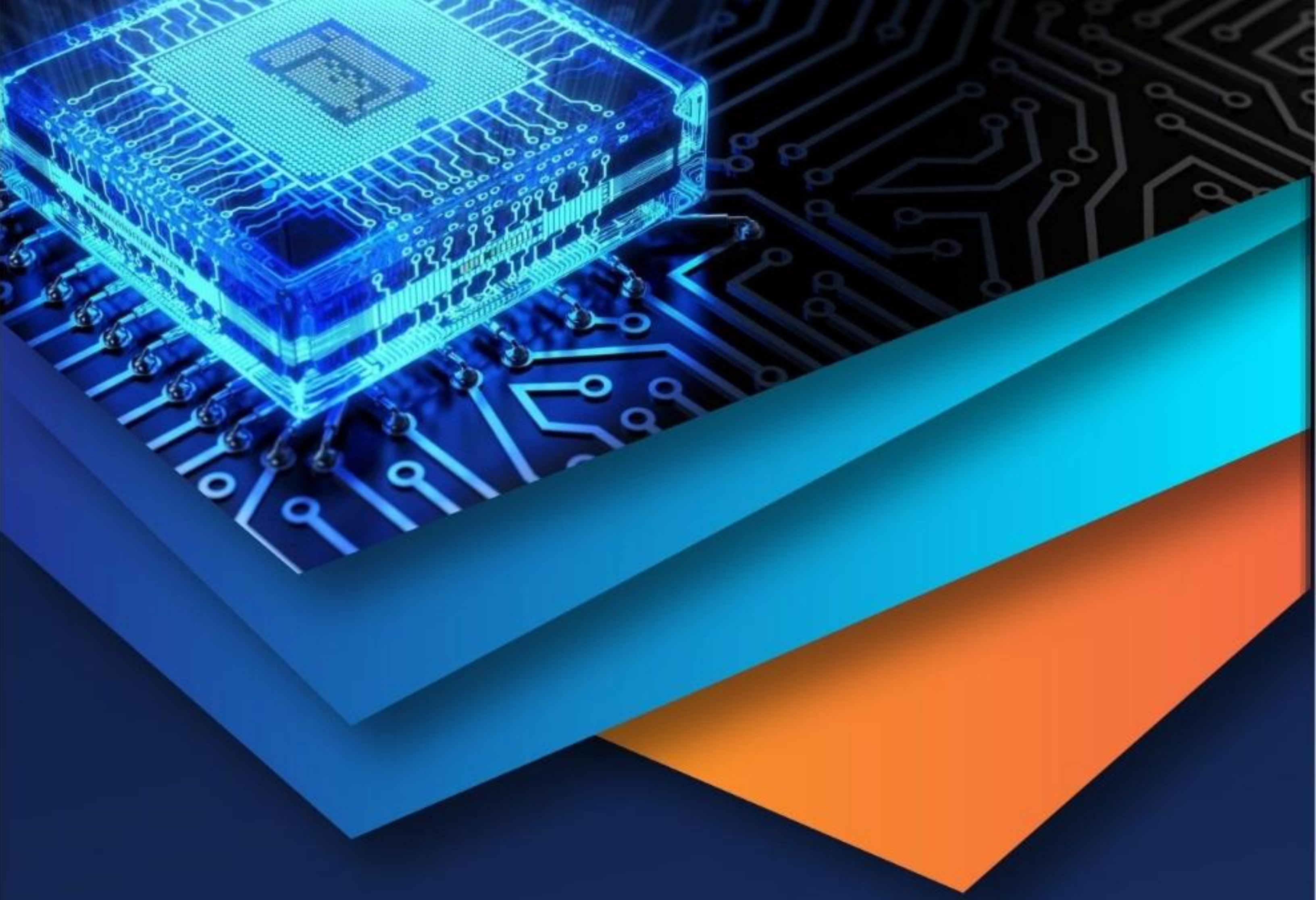

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