Forensic science is the application of natural sciences to the matters of law. It is based on the fundamentals and principle of all basic sciences such as biology, chemistry and physics to provide the actual information which help to proceed legally. Attitude of the scientific and law enforcement cummunities towards forensic science education can appreciate Forensic science and can find various aspects of it that are relevant to their subject matter.

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**Mr. Vivek Khare**
Forensic Expert
M.Sc. in Forensic Science

Mr. Khare is a budding professional in his field. He attained his master's degree in Forensic Science from Institute of Forensic Science & Criminology, Bundelkhand University, Jhansi, Uttar Pradesh. He has presented abstract presentation on "Particle Size Distribution of Soil" at International conference on ICFMT 2016. He has attended various training and workshop during his graduation and post-graduation. He has attended various national and international level seminars and conferences.

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Forensic Science

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## Forensic Science

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Vivek Khare

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# "Particles Size Distribution Of Soil From District Tikamgarh, Madhya Pradesh"

**Submitted By:**

**VIVEK KHARE**
M.Sc Forensic Science
Roll No. – 131282520016

**Supervised By:**
**Dr. Ankit Shrivastava**
Coordinator
IFSC, BU, Jhansi



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# "PARTICLES SIZE DISTRIBUTION OF SOIL FROM DISTRICT TIKAMGARH, MADHYA PRADESH"

**A Dissertation Report submitted to the Bundelkhand University, Jhansi (U.P.)**

Bundelkhand University Jhansi

**In the partial fulfilment for the degree of 'Masters of Science' in Forensic Science (2013-2015)**


**Supervised By:**
**Dr. Ankit Shrivastava**
Coordinator
IFSC, BU, Jhansi

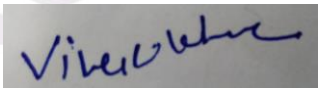
**Submitted By:**
**VIVEK KHARE**
M.Sc Forensic Science
Roll No. – 131282520016


**INSTITUTE OF FORENSIC SCIENCE & CRIMINOLOGY BUNDELKHAND UNIVERSITY JHANSI (U.P.) – 284128**

# DECLARATION

I, hereby, assert that the work presented in this dissertation entitled "Particles size distribution of soil District Tikamgarh Madhya Pradesh" is entirely own work and there are no collaborators. The best of my knowledge this thesis does not contain any work for which any other university has awarded a Degree/ Diploma.

**VIVEK KHARE**
M.Sc Forensic Science
Roll No. – 131282520016



# PREFACE

Forensic science is the application of natural sciences to the matters of law. It is based on the fundamentals and principle of all basic sciences such as biology, chemistry and physics to provide the actual information which help to proceed legally. Attitude of the scientific and law enforcement cummunities towards forensic science education can appreciate Forensic science and can find various aspects of it that are relevant to their subject matter.

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# ACKNOWLEDGEMENT

I'll start thanking to **God**, most gracious and most merciful who bestowed me strength, courage and perseverance to undertaken the present course of study and complete it successfully.

It's my privilege and most amiable duty to acknowledge my deep sense of gratitude to my guide **Dr. Ankit Srivastava**, Coordinator, Institute of Forensic Science and Criminology, Bundelkhand University, Jhansi, for his scrupulous proficient guidance, perpetual encouragement, significant suggestions, overwhelming support and continuous supervision throughout the course of my dissertation work.

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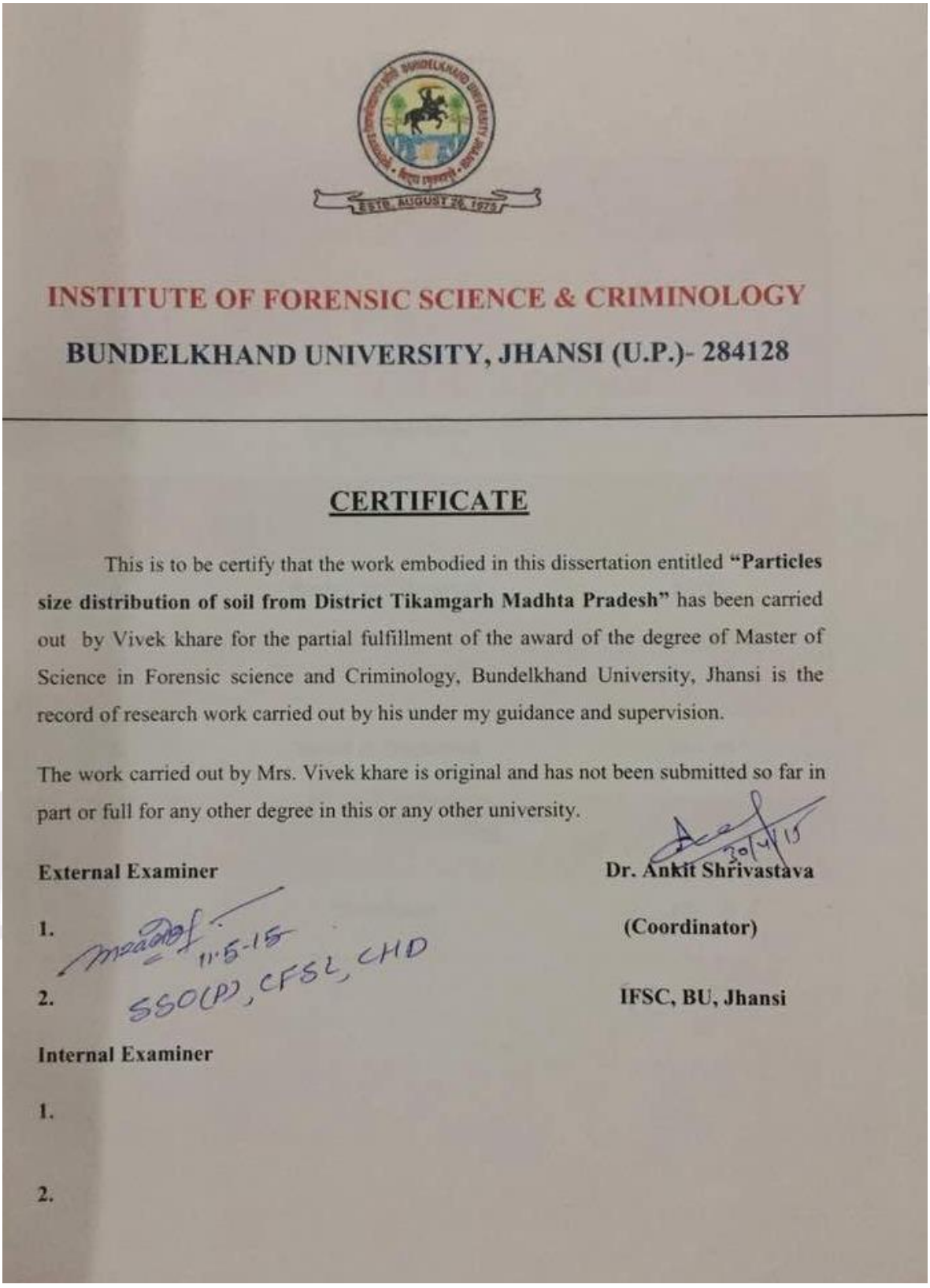
Finally, a very special thanks to my parents for their love, encouragement and financial assistance which made this task happens.

**(VIVEK KHARE)**

# CERTIFICATE



INSTITUTE OF FORENSIC SCIENCE & CRIMINOLOGY

BUNDELKHAND UNIVERSITY, JHANSI (U.P.)- 284128

## CERTIFICATE

This is to be certify that the work embodied in this dissertation entitled **"Particles size distribution of soil from District Tikamgarh Madhta Pradesh"** has been carried out by Vivek khare for the partial fulfillment of the award of the degree of Master of Science in Forensic science and Criminology, Bundelkhand University, Jhansi is the record of research work carried out by his under my guidance and supervision.

The work carried out by Mrs. Vivek khare is original and has not been submitted so far in part or full for any other degree in this or any other university.

30/4/15

**External Examiner** **Dr. Ankit Shrivastava**

**1.** 11.5.15 **(Coordinator)**

**2.** SSO(P), CFSL, CHD **IFSC, BU, Jhansi**

**Internal Examiner**

**1.**

**2.**

# Table of contents

# INTRODUCTION

Soil is the mixture of minerals, organic matter, gases, liquids, and myriad organisms that together support plant life. Two general classes are *topsoil* and *subsoil*. Soil is a natural body that exists as part of the pedosphere and which performs four important functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of the atmosphere of Earth; and it is a habitat for organisms that take part in decomposition of organic matter and the creation of a habitat for new organisms. **(Munnus , 2008)**

Soil is considered to be the "skin of the earth" with interfaces between the lithosphere, hydrosphere, atmosphere of Earth, and bio sphere. Soil consists of a solid phase (minerals and organic matter) as well as a porous phase that holds gases and water. Accordingly, soils are often treated as a three state system. **( Singer, 2010)**

Soil as evidence can provide important information to criminalist in criminal investigation. Many crimes occur under such circumstances where a large amount of soil is transferred and disposed by the criminals. In such cases, soil can be the missing link between a criminal and a scene of crime. The test and control soil samples shall have to be compared for the purpose. Although there are techniques to be employed for discrimination purpose, a simple and rapid screening technique is required for identification of a large number of samples. **( Olawoyin et al, 2012)**

**Types of Soil-**

The soil can be classified into following type-

- **Black soil**
- **Red soil.**
- **Laterite soil**
- **Desert soil.**
- **Mountain soil.**
- **Alluvial soil**.

1. **Black soil** Also known as Regur or Black Cotton soil. Dark grey to Black in color. These soils are made up of volcanic rocks and lava flow. It is concentrated over Deccan Lava Tract which includes parts of Maharashtra, Chhattisgarh, Madhya Pradesh, Gujarat, Andhra and Tamil Nadu. It consists of Lime, Iron, Magnesium and also Potash but lacks in Phosphorus, Nitrogen and Organic matter.

Figure-1 Black soil

2. **Red soil** Formed due to weathering of old crystalline rocks.More sandy and less clayey. Rich in iron, small amount of Humus. Poor in phosphorus, nitrogen and lime. Slightly acidic and do notretain moisture.

Figure-2 Red soil

3. **Laterite soil** Latin word meaning brick. Formed under high temperature and rain fall with wet and dry spell. Silica is leached due to high rainfall. Remnants of iron and aluminum oxides left behind is know as Laterite. Brown to Yellowish color. Become shard when exposed to atmosphere. Used as building material. They are commonly found in Kerala, Tamil Nadu, Maharashtra, Chhattisgarh and hilly areas of Orissa and Assam.

Figure-3 Laterite soil

4. **Desert soil** Contains soluble salts. Originated by Mechanical disintegration & wind deposit. Porousand coarse. 90% sand & 5% clay. Rich in Nitrates &Phosphates. Poor in Nitrogen & Humus. Friable, sandy & low moist content. These soils are generally sandy and deficient in organic matter.

Figure- 4 Desert soil

5. **Mountain soil** Found in hill slopes. Formed by deposition of organic matter from forest. Rich In humus. Poor in Potash and Lime. Areas: Assam, Kashmir, Sikkim & Arunachal Pradesh. Crops: Tea,Coffee, Spices & Tropical Fruits.

Figure-5 Mountain soil

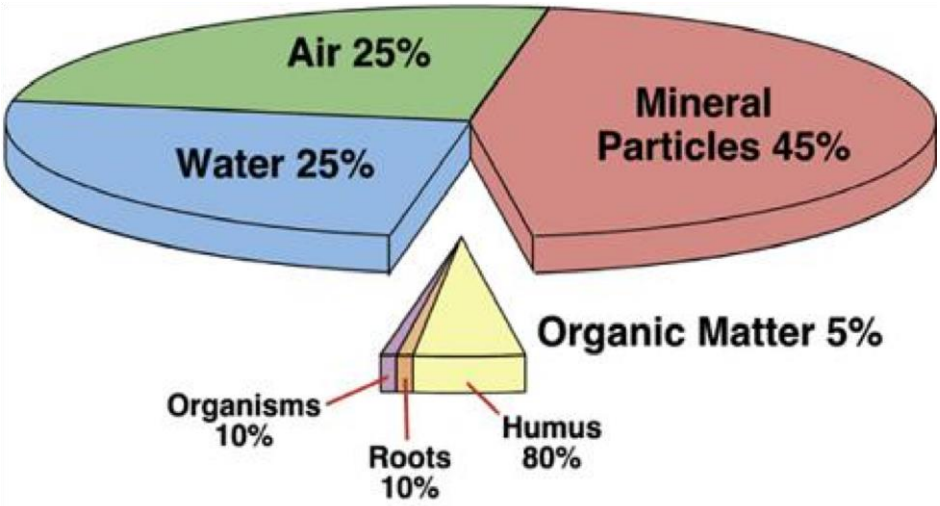
6. **Alluvial soil** soil is formed when a soil carrying stream gradually loses its carrying capacity with decreasing velocity. In slowing down, a river does not have sufficient power to keep the large particles of soil suspended; These particles settle to the riverbed. Further decrease in velocity causes smaller particles to settle. These particles are deposited, finally, at the mouth of the river, where they form DELTAS of fine grained soil . **( Montanarella, 2006 )**

Figure 6- Alluvial soil

**Composition Of Soil**

- Air 25%
- Water 25%
- Mineral particles 45%

- Organic matter 5%




**District Tikamgarh**

Tikamgarh district is one of the 50 districts of Madhya Pradesh state in central India.

Tikamgarh town is the district headquarters.

The district is part of Sagar Division. Tikamgarh is a Yadav dominated region.

It is bounded on the east and southeast by Chhatarpur District of Madhya Pradesh, and by the Uttar Pradesh districts of Lalitpur on the west and Jhansi on the north. Tikamgarh District has an area of 5048 km².

The area covered by this district was part of the Princely State of Orchha till its merger with the Indian Union. The Orchha state was founded by Rudra Pratap Singh in 1501. After merger, it became one of the eight districts of Vindhya Pradesh state in 1948. Following the reorganization of states on 1 November

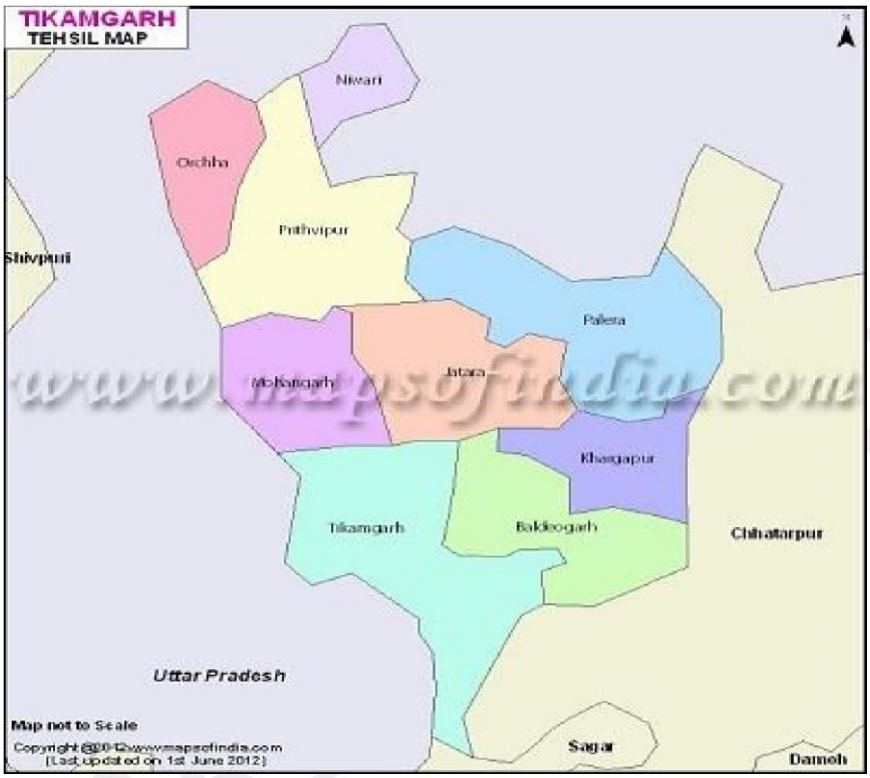
1956 it became a district of the newly carved Madhya Pradesh.

Total area of tikamgarh district in MP. Headquartered at Tikamgarh city, is . 5048 km². Earlier Tikamgarh city was named Tihri but its name changed to tikamgarh in 1783 while then orchha ruler Vikramajit shifted his capital from orchha to tihri.

## Geography Of Tikamgarh City

Tikamgarh is situated at 24.75˚ north latitude,78.83˚ East longitude and 378 meters elevation above the sea level Tikamgarh is a town in india,having about 74,724 inhabitants.

**Map of District Tikamgarh-**




Headquarters – Tikamgarh

**Tahsil**

- Palera
- Prathvipur
- Jatara
- Orchha
- Lidhora
- Khargapur
- Niwari
- Baldevgarh
- Tikamgarh

## Particle Size Distribution Of Soil

**Soil particle-**The description of the grain size distribution of soil particles according to their texture (particle size,shape,gradation).

Particle size distribution is traditionally employed for soil identification and comparison in forensic analysis due to its simplicity. Dudley et al. have suggested that the comparison of particle size distribution with sand fraction in sample of small size is a powerful on to discriminate between soils with 95 % confidence for slit and sand fractions after having been worked in 18 soil samples of small size. Wanogho et al.have reported the controlling factors that affect dry wet sieve analysis. Laser diffraction technique has also been employed for carrying out the same distribution for routine analysis of forensic samples of soil. Particle size distribution analysis and colour comparison have been tried by Erich et al. in order discriminate soil samples. Ritsuko Sugita et al has sustained the validity of particle size distribution. In an another study et al., have employed different methods for assessing the quality and sustainability of soil for agriculture purpose by evaluating particle size distribution of soil. Keneth et al., have explored laser granulometry method for particle size analysis, inductively coupled plasma spectrometry (ICP-AES and ICP-MS) for carbon and nitrogen isotopes and elemental analysis. All the surveyed literature is reflecting the importance of particle size distribution of soil, but none of these is simple and easy.

# REVIEW OF LITERATURE

Review of literature shows the **originality** and **relevance** of your research problem, it also enable us to review all the work that has been previously done of our topic.

**Tamm et al. (1975) s**tudied of heavy minerals in soil profile used to a great extent in problems concerning soil maturity or stage of weathering.

**Dudley et al. (1978)** studied the objective comparison of particle size distribution in soil with particular reference to the sand fraction have suggested that the comparison of particle size distribution with sand fraction in sample of small size is a powerful on to discriminate between soils with 95 % confidence for slit and sand fractions after having been worked in 18 soil samples of small size.

**Wanogho et al. (1987)** studied some factors affecting soil sieve analysis in Forensic Science. Dry Sieving have reported the controlling factors that affect dry wet sieve analysis. Laser diffraction technique has also been employed for carrying out the same distribution for routine analysis of forensic samples of soil.

**Cerniglia et al. (1992)** studied pollutants generally dissipate from soil in a biphasic manner,i.e.a preliminary short period of rapid loss is followed by a subsequent longer period of slower loss.

**Bruce et al. (2000)** studied different amino sugars were used to trace residues of different microbial origin in soils.

**Osinubi (2004)** studied clay mineralogical composition and clay fractions are therefore very important and may be used as a means of soil classification.

**Cengiz et al.( 2005)** has studied on SEM-EDS analysis and discrimination of forensic soil and study was to show the effect of the application of 9 tonnes/cm2 pressure on the elemental compositions obtained by SEM-EDS technique and comparing the discrimination power of the pressed-homogenized and not homogenized forensic soil samples. For this purpose soil samples from 17 different locations of Istanbul were collected. Aliquots of the well mixed samples were dried in an oven at 110-120 degrees C and sieved by using 0.5 mm sieve and then the undersieve fraction(<0.5 mm) of these samples put on an adhesive tape placed on a stub. About 100-150 mg aliquots of dried, sieved samples were pressed under 9 tonnes/cm2 pressure by KBr disk preparation apparatus of an infrared spectrophotometer. Surfaces of the randomized particles and the pressed disks of the soil samples were scanned and the elemental compositions were determined with scanning electron microscope JEO-JSM-5600 equipped with an energy dispersive X-ray spectrometer OXFORD Link-ISIS-300**.**

**Pye (2007)** wrote a book Geological and Soil Evidence Forensic Application. This book contains information and introduction to the nature and properties of geological and soil

materials that may be used as trace evidence, the techniques that may be used to analyze them, and the ways in which the significance of results can be evaluated.

**Gupta et al. (2008)** has worked on SEM-EDX characterization of an Iron-rich Kaolinite clay and she find that SEM-EDX investigation shows that iron-rich Kaolin from deopani deposits of Assam, India contains pseudo hexagonal kaolinite particles in face to face arrangement,quartz and titaniferous minerals. SEM investigation indiacates that amounts of patches in acid treated fractions are less than corresponding and EDX analysis also shows that Fe and Ti contents of patches are less in acid leached fractions and are minimum in fine fraction of clay.

**Ramamurthy et al. (2009)** has studied SEM-EDS Analysis of soil and plant (*Calotropis Gigantea* Linn) collected from an industrial village, Cuddalore DT, Tamil Nadu, India to investigate the effects of the atmospheric emissions of heavy metals in soil and plants collected from an industrial area. In this connection the environmental pollution of the bioindicators (soil and plant) have been analyzed by SEM-EDS method by estimating heavy metals like Na, Mg, Al, Si, Cl, K, Ca, Mn, Fe, Cr, Co, Ni, Cu, Zn, As, Se, Pb and Cd. From this analysis, a perceptible variation in the trace element concentration of samples in different seasons is found.

**Onion (2009)** studied the characterization of soil with the use of various instrumental techniques.

**Harris et al. (2009)** studied crystalline mineralogical components of clay fraction of soil are most readily identified by the powder method of x-ray differaction analysis.

**Mayuva et al. (2009)** worked on microanalysis by SEM-EDX on Structure and Elemental Composition of Soils from Different Agriculture Areas in the Western Region of Thailand. Scanning electron microscope and energy dispersive X-ray microanalysis (SEM/EDX) determined the microstructure of soil formation and particle intact condition well in all soil samples. EDX detected the emission of the elements of oxygen (O), magnesium (Mg), aluminum (Al), potassium (K), silicon (Si), calcium (Ca), titanium (Ti), sodium (Na) and iron (Fe). The percentage of all elements was investigated as following order: O > Si >Al > Fe > K > Mg > Ca >Ti>Na. Soil from natural agricultural system showed the significantly highest levels of O, Mg and K; the elements are essential for plant growth. Whereas, soil from the chemical management system showed the significantly highest levels of Al and Si. The results indicated that the combination of SEM and EDX was excellent tool, power full, comfortable technique to determine the microstructure of soil formation and a better understanding of soil elemental composition.

**Al-Saad et al.(2010)** Determination of depleted uranium in the presence of natural uranium in environmental soil samples by ICP-MS after sequential extraction. It was observed from sequential experiment that uranium was brought into solution and mainly appeared at steps for dilute acid-soluble, carbonate-bound and organic matter-bound species. Little redistribution was observed at steps for exchangeable and Fe-Mn oxide-bound species. The detection limit of 235 U and 238 U isotopes, trueness, precision, specificity, and stability were determined. The recoveries of the uranium through whole extraction procedure were in the range of 87 - 96%.

**Gangwar et al. (2010)** analysis of Particle Size Distribution to the sand fractions in soil samples for Forensic purpose. The analysis of data obtained for various sand fractions indicates that the contributions of FS and VFS in sand come to 70% and 20% respectively. The contribution of each of MS and CS is about 5%. The reproducibility of the technique shows that the CV varies up to 5%. The CV % of sand fractions within the sample is limited to 20%. The CV% for different fractions extends up to 100% depends upon the percentage of sand present in the samples and their variation from fraction to fraction.

**Panishkan et al. (2010)** soil Classification Based on their Chemical Composition Using Principal Component Analysis**.** Principal component analysis (PCA), was used to group of 54 soil samples collected from different agricultural locations in the western part of Thailand. Soil chemical compositions were measured by Scanning Electron Microscope (SEM) and Energy Dispersive X-ray Microanalysis (EDX). The basic result indicated decreased amount of O, Si, Al, Fe, C, K, Mg, Ca, Ti and Na. The first three principal components were used and accounted for 44.0%, 19.5% and 15.0% of total variation of the data, respectively. Score plots of first three principal components were used to map with soil textures classified as clay, clay loam and medium loam. The results showed some relationships between chemical contents and soil textures.

**Solanki et al. (2012)** soil can develop from weathered rocks, volcanic ash deposits or accumulated plant residues.

**Shafer (2014)** found that single index properties are not sufficient to estimate the free swell or the swell pressure of expansive soils. In order to have a significant correlation, two or more index properties should be combined when estimating the swell potential.

# Materials and Methods

Particle size distribution of soil sample of various places of District Tikamgarh has been carried out, the methodology of this study is described below.

## Material

**Sample collection**- Polythene bag, gloves, spoon ,Set of sieves 2mm to.20mm, motor-driven sieve shaker, digital balance and labeling stickers and pen.

- **Sample collection**

The soil samples for this study have been collected at large about 150 gm each from different location of District Tikamgarh city and it's outskirts area and the sample are collected near the road side from upper surface of earth. The soil samples were stored in plastic bag. Then about 50 gm of each sample has been taken in plastic bag for analysis bag for the elemental analysis of soil and their Particle Size Distribution.

- **Sample preparation-** The soil samples prepared dry in sun light for the study of particles size distribution.

**Table Of Collected Soil Sample**

| Sample No. | Area | Place |
|---|---|---|
| 1 | Tikamgarh | Near Railway station |
| 2 | | Near Bus stand |
| 3 | | Hanuman mandir |
| 4 | | Pakoda Chaurahe |
| 5 | | Main market |
| 6 | Niwari | Niwari tigella |
| 7 | | Matan mohalla |
| 8 | | Kanchan pura |
| 9 | | Dubey chock |
| 10 | | Niwari tehsil |

| | | |
|---|---|---|
| 11 | Prathvipur | Bus stand |
| 12 | | Near junior high sch. |
| 13 | | Pasrat mohalla |
| 14 | | Rani ganj |
| 15 | | Aajad nagar |
| 16 | Khargapur | Railway station |
| 17 | | Bus stand |
| 18 | | Sabji mandi |
| 19 | | Main market |
| 20 | | Khargapur tigella |
| 21 | Palera | Bus stand |
| 22 | | Near post office |
| 23 | | Bajaria chock |
| 24 | | Near mata mandir |
| 25 | | Satyam nagar |
| 26 | Jatara | Bus stand |
| 27 | | Bada bajar |
| 28 | | Near sabji mandir |
| 29 | | Near govt.hospital |
| 30 | | Near inter collage |
| 31 | Orchha | Near ramraja mandir |
| 32 | | Fort |
| 33 | | Near Betwa river |
| 34 | | Sataar colony |
| 35 | | Dwarika colony |
| 36 | Lidhora | Bus stand |
| 37 | | Main market |
| 38 | | Near govt. hospital |
| 39 | | Manik ganj |
| 40 | | Near char khamba |
| 41 | Baldevgarh | Bus stand |
| 42 | | Baldevgarh tigella |
| 43 | | Badi mandi |
| 44 | | Near kali tample |
| 45 | | Near inter collage |

**METHODOLOGY-**

The soil sample is taken 50 g in weight. After then the set of sieve is arranged in numerical order with smallest sieve (largest mesh size) at the top and the largest sieve (smallest

mesh size) at the bottom. Than place the sieves on the shaker and pour the soil sample into the top sieve. Place the cover on the upper sieve, fasten the binding strap. Switch on the shaker and allow the shake to operate for 5 minutes. Then, switch off the shaker and release the binding straps. Remove the sieve cover and separate the sieves. Collect the soil retained in each sieve separately and mark them then Collect the soil retained in the each sieve separately and reweight accurately.

# RESULT AND DISCUSION

In the present study has been carried out on the 45 soil samples collected from different localities of District Tikagarh. The particle size distribution 50 gm soil of each sample were taken and passed from different sieves of varying sizes (2.00mm, 1.204mm, 0.295mm, 0.211mm, 0.15mm ) and processed. The retained soil were collected and the percentage of retained soil was calculated as shown below. On the basis of the calculated percentage of the retained soil of each sieve ( shown in table ), It is found that the particle size of each soil sample differs from area to area and location to location.

**Table No.1-**

**Particles size distribution of Soil (Tikamgarh Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Tikamgarh Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 47.8 | 24.08 | 6.04 | 6.52 | 12.2 |
| 2 | 65.32 | 34.2 | 3.5 | 2.84 | 13.1 |
| 3 | 57.64 | 37.26 | 4.38 | 2.76 | 7.48 |
| 4 | 53.44 | 34.36 | 6.64 | 6.1 | 19.26 |
| 5 | 54.02 | 17.2 | 1.24 | 1.6 | 24.02 |

In the table 1, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"** 47.8 to 54.02 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm 0.295 mm)"**24.8 to 17.2 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**6.04 to 1.24 , sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"** 6.52 to 1.6 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"** 12.2 to 24.2

**Table No.2-**

**Particles size distribution of Soil ( Niwari Tahsil)**

The above study has been carried out on the 5 soil samples collected from road side from different areas of Niwari Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm– 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 53.24 | 29.26 | 3.36 | 3.5 | 10.16 |
| 2 | 74.16 | 16.12 | 1.76 | 1.26 | 3.76 |
| 3 | 68.34 | 24.48 | 2.66 | 2.58 | 11.28 |
| 4 | 53.06 | 31.92 | 6.1 | 6.48 | 22.1 |
| 5 | 61.02 | 20.3 | 3.64 | 2.8 | 6.9 |

In the table 2, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"** 53.24 to 61.02 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**29.26 to 20.3 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**3.36 to 3.64 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**3.5 to 2.8 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**10.16 to 6.9

**Table No.3-**

**Particles size distribution of Soil (Prathvipur Tahsil)**

The above study has been carried out on the 5 soil samples collected from road side from different areas of Prathvipur Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine (below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 64.01 | 27.14 | 5.01 | 3.48 | 19.2 |
| 2 | 57.3 | 29.64 | 6.66 | 6.8 | 21.8 |
| 3 | 59.56 | 25.4 | 5.18 | 2.9 | 6.76 |
| 4 | 31.4 | 30.66 | 5.76 | 3.6 | 17.6 |
| 5 | 47.8 | 24.08 | 6.04 | 6.52 | 12.2 |

In the table 1, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**64.01 to 31.04 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**27.14 to 30.66 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**5.1 to 5.76 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"** 3.48 to 3.06 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**19.2 to 17.6

**Table No.4-**

**Particles size distribution of Soil (Khargapur Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Khargapur Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 65.32 | 34.2 | 3.5 | 2.84 | 13.1 |
| 2 | 57.64 | 37.26 | 4.38 | 2.76 | 7.48 |
| 3 | 53.44 | 34.36 | 6.64 | 6.1 | 19.26 |
| 4 | 66.36 | 18.04 | 3.82 | 2.6 | 6.02 |
| 5 | 64.74 | 23.92 | 3.18 | 1.8 | 6.02 |

I0n the table 4, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**65.32 to 64.74 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**34.2 to 23.92 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**3.5 to 3.18**,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**2.84 to 1.8 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**13.1 to 6.0

**Table No. 5-**

**Particles size distribution of Soil (Palera Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Palera Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | 65.26 | 23.28 | 2.76 | 1.86 | 5.56 |
| 2 | 61.14 | 26.84 | 3.38 | 2 | 5.08 |
| 3 | 43.94 | 35.52 | 4.36 | 2.12 | 10.76 |
| 4 | 38.08 | 34.04 | 4.64 | 2.88 | 8.46 |
| 5 | 69.54 | 22.02 | 2.36 | 1.4 | 4.36 |

In the table 5, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**65.26 to 69.54 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**23.28 to 22.02 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**2.76 to 2.36 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**1.86 to 1.4 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**5.56 to 4.36.

**Table No. 6-**

**Particles size distribution of Soil (Jatara Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Jatara Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 61.16 | 27.05 | 2.92 | 1.94 | 5.2 |
| 2 | 53.58 | 29.46 | 4.2 | 2.92 | 8.8 |
| 3 | 43.72 | 36.6 | 4.14 | 2.8 | 11.74 |
| 4 | 58.14 | 24.06 | 6.76 | 5.16 | 16.2 |
| 5 | 52.02 | 30.36 | 6.1 | 5.8 | 17.14 |

In the table 6, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**61.16 to 52.02 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**27.05 to 30.36 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**2.92 to 6.1 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**1.94 to 5.8 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**5.2 to 17.14.

**Table No. 7-**

**Particles size distribution of Soil (Orchha Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Orchha Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 37.72 | 34.42 | 5.04 | 6.64 | 13.84 |
| 2 | 41.68 | 32.72 | 4.24 | 3.14 | 6.64 |
| 3 | 47.02 | 33.24 | 4.54 | 3 | 11.24 |
| 4 | 56.96 | 19.56 | 2.44 | 1.76 | 18.04 |
| 5 | 57.03 | 27.03 | 3.03 | 2.06 | 8.34 |

In the table 7, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**37.72 to 57.03 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm 0.295 mm)"**34.42 to 27.03 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**5.04 to 3.03 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**6.64 to 2.06 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**13.84 to 8.34.

**Table No.8-**

**Particles size distribution of Soil (Lidhora Tahsil)**

The present study has been carried out on the 5 soil samples collected from road side from different areas of Lidhora Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 67.14 | 19.8 | 2.2 | 1.56 | 7.98 |
| 2 | 43.98 | 37.54 | 4.04 | 2.82 | 10.08 |
| 3 | 59.56 | 25.4 | 5.18 | 2.9 | 6.76 |
| 4 | 31.4 | 30.66 | 5.76 | 3.6 | 17.6 |
| 5 | 47.8 | 24.08 | 6.04 | 6.52 | 12.2 |

In the table 8, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**67.14 to 47.8 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**19.8 to 24.8, sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"**2.2 to 6.04**,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**1.56 to 6.52 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**7.98 to 12.2.

**Table No.9-**

**Particles size distribution of Soil (Baldevgarh Tahsil)**

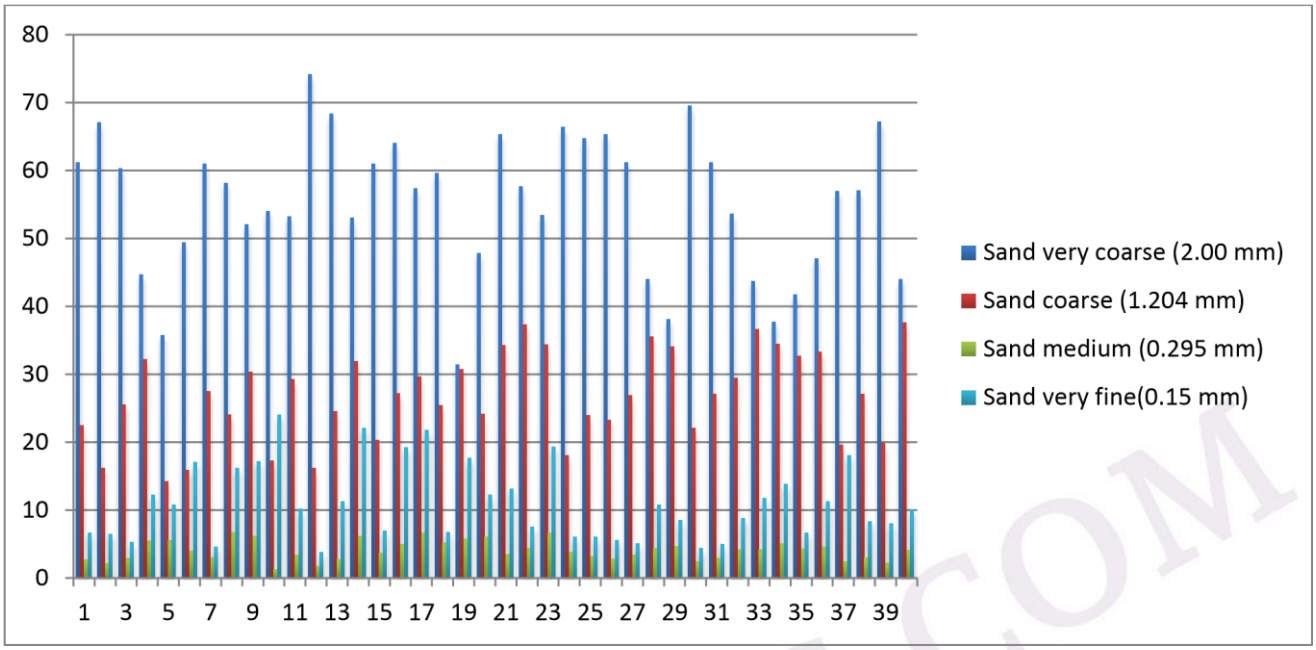
The present study has been carried out on the 5 soil samples collected from road side from different areas of Baldevgarh Tahsil. For the study of particles size distribution of soil.

| Sample no. | Sand very coarse (2.00 mm – 1.204mm) | Sand coarse (1.204 mm – 0.295 mm) | Sand medium (0.295 mm – 0.211 mm | Sand fine (0.211 mm – 0.15 mm) | Sand very fine(below 0.15 mm ) |
|---|---|---|---|---|---|
| 1 | 65.32 | 34.2 | 3.5 | 2.84 | 13.1 |
| 2 | 57.64 | 37.26 | 4.38 | 2.76 | 7.48 |
| 3 | 53.44 | 34.36 | 6.64 | 6.1 | 19.26 |
| 4 | 69.21 | 19.8 | 4.02 | 1.85 | 7.98 |
| 5 | 55.21 | 24.51 | 4.52 | 2.45 | 11.02 |

In the table 9, sieve no. 1 non pass soil is considered as "**Sand very coarse (2.00 mm – 1.204 mm)"**65.32 to 55.21 , sieve no.2 pass soil is considered as **"Sand coarse (1.204 mm – 0.295 mm)"**34.2 to 24.51 , sieve no.3 pass soil is considered as "**Sand medium (0.295 mm – 0.211 mm)"** 3.5 to 4.52 **,** sieve no.4 pass soil is considered as **"Sand fine (0.211 mm – 0.15 mm)"**2.84 to 2.45 and sieve no.5 pass is considered as **"Sand very fine (below 0.15 mm)"**

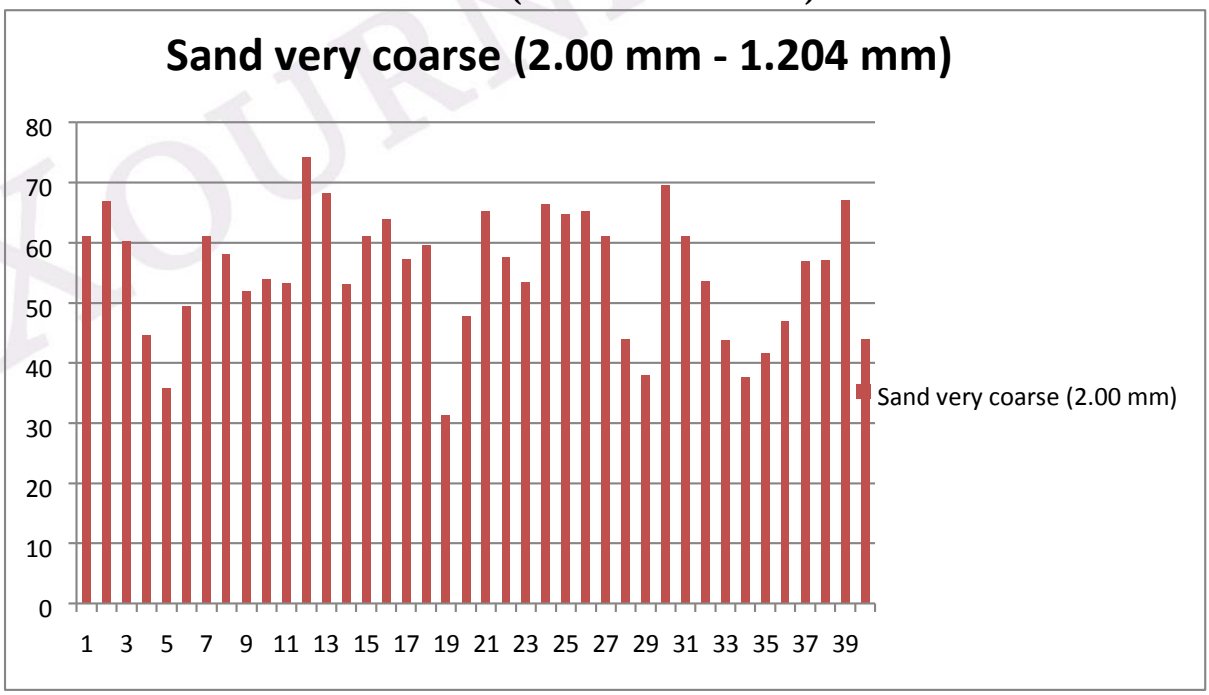
In the table 1 to 9, the percentage of retained soil of each sieve shows that the particle size of each soil sample studied here under is different the reason may be due to climatic conditions, soil texture or due to the contamination in soil

**Graph 1: Particle size distribution**



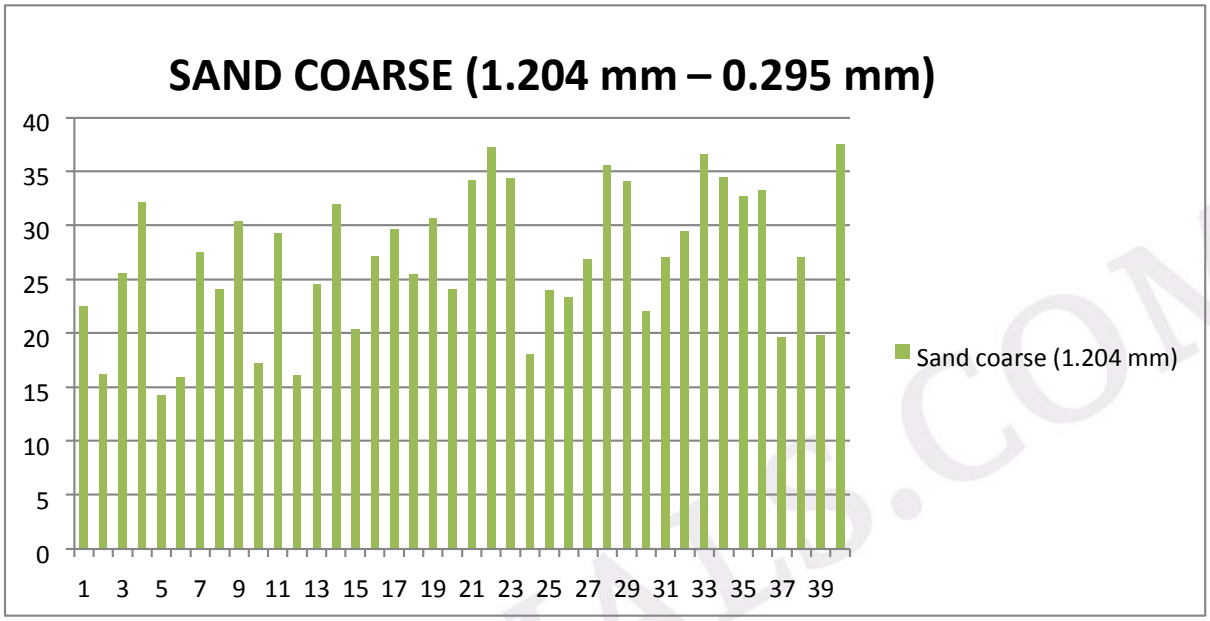

The Graph 1 of particle size distribution shows the difference in the size of particles of each sieve in all the soil samples. The X axis shows the number of samples and the Y axis shows the percentage of retained soil.

**GRAPH 2 – SAND VERY COARSE (2.00 mm – 1.204 mm)**



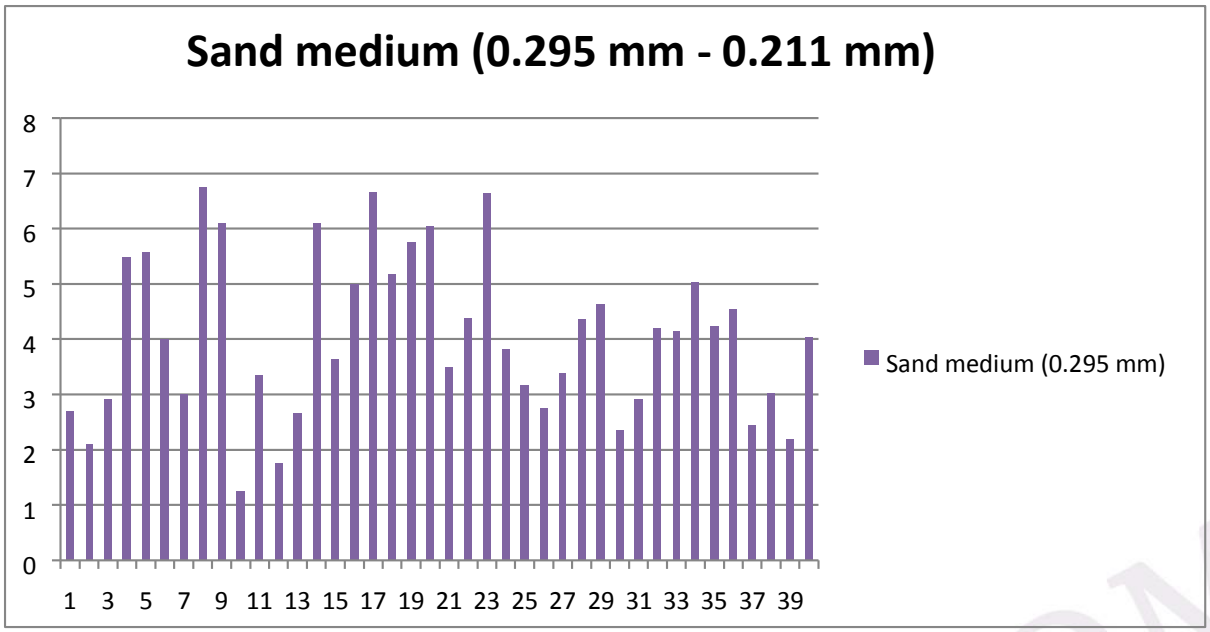
The Graph 2 shows the retained soil percentage of Sand very coarse (2.00 mm – 1.204 mm) in the samples. In this chart X axis shows the sample number and Y axis shows the percentage of retained soil percentage of sand very coarse (2.00 mm – 1.204 mm). In this is chart the common percentage of sand very coarse in the entire samples is lies in between 32 to 41.

**GRAPH-3 SAND COARSE (1.204 mm – 0.295 mm)**



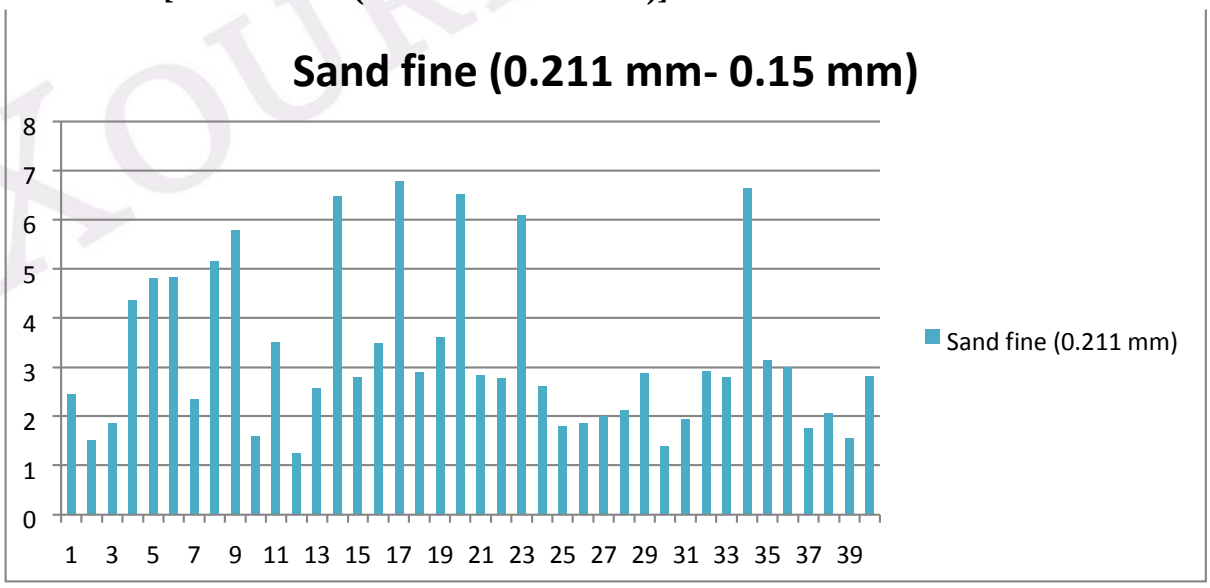

The Graph 3 shows the retained soil percentage of sand coarse (1.204 mm – 0.295 mm) in the samples. In this chart X axis shows the sample number and Y axis shows the retained soil percentage. In this chart the common percentage of sand coarse (1.204 mm – 0.295 mm) in all the samples is in between 10 to 19.

**GRAPH- 4 [SAND MEDIUM (0.295 mm – 0.211 mm)]**



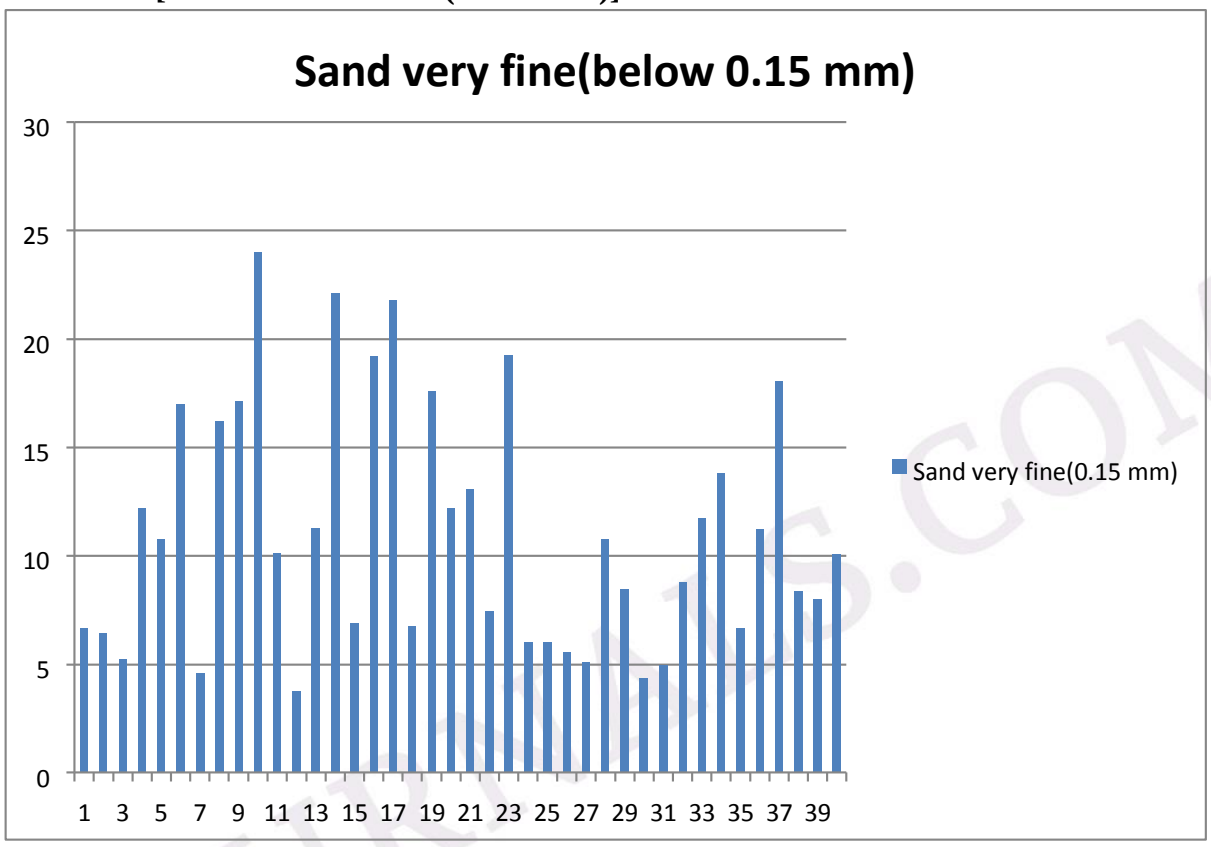

The Graph 4 shows the retained soil percentage of sand medium (0.295 mm – 0.211 mm) in the samples. In this chart X axis shows the sample number and Y axis shows the retained soil percentage. In this chart the common percentage of sand medium (0.295 mm – 0.211 mm) in all the samples is in between 5 to 9.

**GRAPH -5 [SAND FINE (0.211 mm – 0.15 mm)]**



The Graph 5 shows the retained soil percentage of sand fine (0.211 mm – 0.15 mm) in the samples. In this chart X axis shows the sample number and Y axis shows the retained soil percentage. In this chart the common percentage of sand fine (0.211 mm – 0.15 mm) in all the samples is in between 6 to 8.

**GRAPH-6 [SAND VERY FINE (below 0.15)]**




The Graph 6 shows the retained soil percentage of sand very fine (below 0.15 mm) in the samples. In this chart X axis shows the sample number and Y axis shows the retained soil percentage. In this chart the common percentage of sand very fine (below 0.15 mm) in all the samples is in between 10 to 12.

# SUMMARY AND CONCLUSION

Soil is the mixture of minerals, organic matter, gases, liquids, and myriad organisms that together support plant life. Two general classes are *topsoil* and *subsoil*. Soil is a natural body that exists as part of the pedosphere and which performs four important functions

The above study has been carried out on the 45 soil samples collected from road side from different areas of District Tikamgarh. In this study the Particle Size Distribution of soil samples has been carried out by using simple separation technique through sieving mishen.

The Particle Size Distribution of Soil samples which were taken for this study shows that the particles of soil are different and shows a large variation of particles from area to area.

In the particle size distribution the percentage of sand very coarse is laying in between 32 to 41% , sand coarse is laying in between 10 to 19% , sand medium is laying in between 5 to 9%, sand fine is laying in between 6 to 8% and sand very fine is laying in between 10 to 12%.

This study of soil samples of District Tikamgarh will help to the Forensic Community and investigating agencies to locate the scene of crime in tikamgarh and to prove it in the court & law.

# Discussions

The above study has been carried out on the 45 soil samples collected from different Localities of District Tikamgarh . The Particle Size Distribution of collected soil samples has been carried out by using simple separation technique through sieving mishen. Similarly study of kumar (2011) on the 40 soil samples collected from road side from different areas of Kolkata (W.B). In this study the Particle Size Distribution of soil samples has been carried out by using sieving mishen.

The Particle Size Distribution of collected Soil samples shows that soil particles persist a large variation based on location. Similarly Vivek (1) concluded that the Particle Size Distribution of Soil samples which were taken for his study shows that the particles of soil are different and shows a large variation of particles from area to area.

Result of the present study particles size distribution of soil is similar with the results of kumar sir (2011). In this study we analysed 45 soil sample of District Tikamgarh Madhya Pradesh.

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