National Institute of Technology Karnataka Surathkal,
Mangalore - 575025

DEPARTMENT OF WATER RESOURCES AND OCEAN ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING

ESTIMATE RUNOFF BY SCS-CN METHOD

Report Submitted for Mini Project- I (AM380) By

Adarsh Kumar	181CV102
Anuj Singh	181CV106
Gaurav Chaurasia	181CV155
Sachin Saroha	181CV137

Under the Guidance of

Dr. Lakshman Nandagiri

DECLARATION

We hereby declare that the report of the B.Tech Mini Project - I (AM380) entitles "**ESTIMATE RUNOFF BY SCS-CN METHOD**", which is being submitted to the National Institute of Technology Karnataka, Surathkal, is a bonafide report of the work being carried out by us. The material contained in this report has not been submitted to any other University or Institution.

_____	_____
Adarsh Kumar (181CV102)	Anuj Singh (181CV106)
_____	_____
Gaurav Chaurasia(181CV155)	Sachin Saroha (181CV137)

Department of Civil Engineering
Place: NITK, SURATHKAL
Date: 19th November, 2020

CERTIFICATE

This is to certify that the U.G. Project Work Report entitled “ESTIMATION RUNOFF BY SCS-CN METHOD” submitted by Mr. Adarsh Kumar (181CV102) , Anuj Singh (181CV106), Gaurav Chaurasia (181CV155) and Sachin Saroha(181CV137) as the record of the work carried out by them is accepted as the U.G. Minor Project - I report submission in partial fulfillment of the requirements for the award of the degree of BACHELOR OF TECHNOLOGY in CIVIL ENGINEERING in the DEPARTMENT OF CIVIL ENGINEERING, N.I.T.K, Surathkal during the year 2020-2021, is a bonafide work carried out by them under my supervision and guidance.

_____

Dr. LAKSHMAN NANDAGIRI

Professor

Department of Water Resources & Ocean Engineering

N.I.T.K, SURATHKAL

_____

Dr. AMBA SHETTY

Head of the department

Department of Water Resources & Ocean Engineering

N.I.T.K. SURATHKAL

ACKNOWLEDGEMENT

We take this opportunity to express our sincere gratitude and profound thanks to our guide **Dr. Lakshman Nandagiri** , Professor, Department of Water Resources & Ocean Engineering, National Institute of Technology Karnataka, Surathkal for his advice, expert guidance, constant encouragement and reference material provided during the course of the preparation of the U.G. Project Work Report. We would like to express our sincere gratitude to **Dr. Amba Shetty**, Professor and Head of the Department of Water Resources & Ocean Engineering, National Institute of Technology Karnataka, Surathkal for providing necessary facilities and sincere cooperation. We would also like to thank all the teaching and non-teaching staff of Department of Civil Engineering & Department of Applied Mechanics and Hydraulics, National Institute of Technology Karnataka, Surathkal for their cooperation and help during the project work. We would like to thank all our friends and classmates for their continuous help and encouragement, without whom this project would not have been completed successfully. Above all we thank Lord, the almighty for his grace throughout the work.

Adarsh Kumar	181CV102
Anuj Singh	181CV106
Gaurav Chaurasia	181CV155
Sachin Saroha	181CV137

TABLE OF CONTENT

ABSTRACT

The SCS curve number method is a simple, widely used and efficient method for determining the approximate amount of runoff from rainfall even in a particular area. Although the method is designed for a single storm event, it can be scaled to find average annual runoff values. The stat requirements for this method are very low, rainfall amount and curve number. The curve number is based on the area's hydrologic soil group, land use , treatment and hydrologic condition. The 2 former being of greatest importance.

The web application we developed is based on the SCS-CN method only and depending on data given by the user it can estimate total runoff depth, runoff volume for a given area, and more insights. With the help of this application, we can get insights of runoff generated in different areas or zones and further can be used for making watersheds ...etc.

Talking more on our application currently is in the working stage it can calculate runoff with the help of curve number and other required data but for soil type, land use, and other parameters it is not completely automated, hence the user has to refer to the reference tab provided in web application and enter data accordingly in order to estimate runoff and use it further.

INTRODUCTION

Runoff generated in a river basin contributes significantly to the river discharge. River basin characteristics such as length, slope, land use and basin shape have significant impact on the runoff generated from the river basin. There are a number of methods available for rainfall runoff modeling such as hydrologic models, empirical equations and data driven techniques to correlate rainfall and runoff. Soil Conservation Services and Curve Number (SCS– CN) technique is one of the primogenital and simplest methods for rainfall runoff modelling. Land cover information is used in hydrologic modeling to estimate the value of surface roughness or friction as it affects the velocity of the overland flow of water. It may also be used to determine the amount of rainfall that will infiltrate into the soil. Mockus used data on soil, land use, antecedent rainfall, storm duration, and average annual temperature to temperature to estimate surface runoff in ungauged catchments. NEH developed —SCS-CN method ‖ . The method requires numeric catchment characteristics which are the basis of catchment runoff determination. The objective of the method is to determine the accurate curve number of the catchment of interest that defines the runoff potential. Hydrologic soil group number, land use type, vegetation cover, soil conservation measures, antecedent soil moisture conditions are the basic catchment characteristics used for curve number calculations. Sharma et al. studied the hydrologic response of a watershed to land use changes based on the Geographical Information System (GIS) and Remote Sensing (RS) approach. Gangodagamage and Agarwal carried out hydrological Modeling using remote sensing and GIS. Accurate modeling will require estimation of

the spatial and temporal distribution of the water resources parameters. The present work aims to prioritize watershed of Sone canal based on runoff generated, expressed as yield, due to existing land use conditions, and to evaluate the hydrologic response of these measures on runoff.

The general equation for the SCS curve number method is as follows:
The initial equation (1) is based on trends observed in data from collected sites, therefore it is an empirical equation instead of a physically based equation. After further empirical evaluation of the trends in the database, the initial abstractions, Ia, could be defined as a percentage of S (2). With this assumption, the equation (3) could be written in a more simplified form with only 3 variables. The parameter CN is a transformation of S, and it is used to make interpolating, averaging, and weighing operations more linear (4).

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \qquad (1)$$

Q=Runoff
P=Rainfall
S=Potential maximum retention after runoff begins
I_a =Initial Abstraction

$$I_a = \lambda S \qquad (2)$$

$$Q = \frac{(P - \lambda S)^2}{(P - \lambda S) + S} \qquad (3)$$

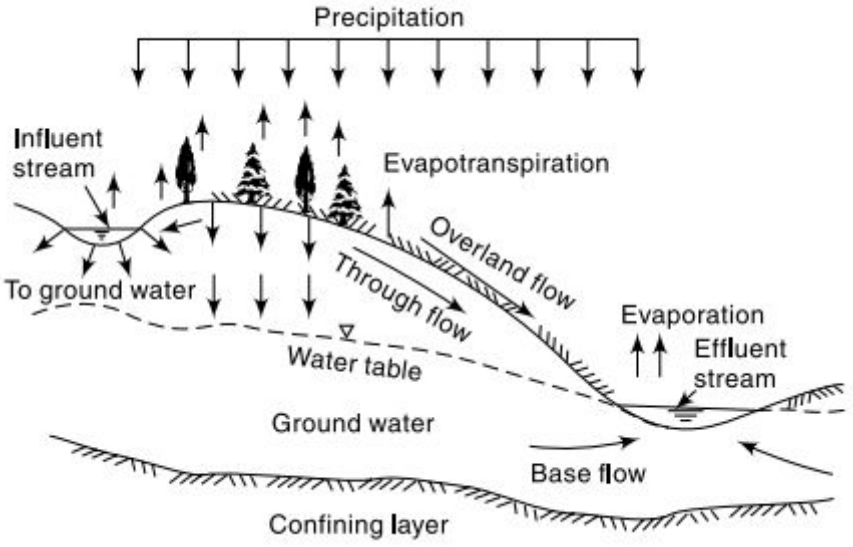
$$S = \frac{1000}{CN} - 10 \qquad (4)$$

THEORY

RUNOFF

Runoff means the draining or flowing off of precipitation from a catchment area through a surface channel. It thus represents the output from the catchment in a given unit of time.

Consider a catchment area receiving precipitation. For a given precipitation, the evapotranspiration, initial loss, infiltration and detention storage requirements will have to be first satisfied before the commencement of runoff. When these are satisfied, the excess precipitation moves over the land surfaces to reach smaller channels. This portion of the runoff is called *overland flow* and involves building up of the storage over the surface and drainage off the same. Usually the lengths and depths of overland flow are small and the flow is in the laminar regime. Flows from several small channels join bigger channels and flows from these in term to combine to form a larger stream, and so on, till the flow reaches the catchment outlet. The flow in this mode, where it travels all the time over the



surface as an overland flow and through the channels as open-channel flow and reaches the catchment outlet is called *surface runoff*.

A part of the precipitation that infiltrates moves laterally through the upper crust of the soil and returns to the surface at some location away from the point of entry into the soil. This component of runoff is known variously as interflow, throughflow, storm seepage, subsurface stone flow or quick return flow. The amount of inter flow depends on the geological condition of the catchment. A fairly pervious soil overlying a hard impermeable surface is conducive to large inter flows. Depending upon the time delay between the infiltration and Anta outflow, the interflow is sometimes classified into a prompt interflow that is the interflow with the least time lag and the delayed interflow.
Another route for infiltrated water is to undergo the percolation and reach the what groundwater storage in the soil groundwater follows a complicated and long path of travel and ultimately reaches the surface the time black that is the difference in that time between the entry into the soil and outflow from it is very large being of the order of month and year this part of runoff is called groundwater runoff or groundwater flow groundwater flow provides the driver the weather flow in a funnel stream.
Based on the time delay between the precipitation and the run of the runoff is classified into categories; as

1. *Direct Runoff*
2. *Base Flow*
3. *Natural Flow*

SCS-CN METHOD OF ESTIMATING RUNOFF VOLUME

Direct runoff from a watershed produced by a given precipitation, may be estimated using various models. Out of these models, SCS-CN model is widely used for estimating runoff on small to medium sized ungauged drainage basins. The SCS method of estimating runoff from storm rainfall was developed by USDA scientists. The SCS approach involves the use of simple empirical formulas, tables and curves. The empirical equations require the rainfall and watershed coefficient as inputs. The watershed coefficient called as curve number (CN)is an index that represents the combination of hydrologic soil group and land use and land treatment classes. SCS model enables the hydrologist to stimulate the various design alternatives and compare the result. The parameter defined by land use allows the user to experiment with alternative forms of land development and management and to assess the impact of the proposed changes. The soil map of the study area was scanned and then registered with the help of geo-referenced SOI topographical map. The registered soil map was digitized, and different soil attributes were assigned to the different soil groups as described in Table 1. Hydrologically soils are assigned into four groups based on intake of water on bare soil when thoroughly wetted. The hydrologic soil group classification is based on texture of soil as presented in Table 2. The expression used in SCS method for estimating runoff may be presented as

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S}$$

Where, Q=Accumulated storm runoff, m; P=Accumulated storm rainfall, mm, S=potential maximum retention of water by the soil, Ia= initial quantity of interception, depression and infiltration. To simplify the above equation empirical relationship between the variables S and Ia was developed from data collected from various watersheds in the U.S.A resulting in the following equation.

Ia= 0.3S for AMC I, Ia= 0.2S for AMC II, Ia= 0.1S for AMC III

The central soil and water conservation Research and Training institute (ICAR) Dehradun has suggested some of the empirical relation for Indian condition which suggests that forBlack soil region AMC-II and III, Ia=0.1S, Black soils region AMC I, Ia=0.3S, all other region, Ia=0.3S, S value is derived from curve number (CN) using following formulae

$$S = \frac{25400}{CN} - 254$$

Where CN= function of watershed hydrologic land use/land cover units hydrologic soil groups antecedent moisture condition. CN values can be obtained for different land uses and hydrologic condition from the standard Table CN values for AMC-I and II can be obtained using the following empirical equation:

$$CNI = \frac{4.2 \times CNII}{10 - 0.058 \times CNII}$$

$$CNIII = \frac{23 \times CNII}{10 - 0.13 \times CNII}$$

ILWIS software and ERDAS IMAGINE software were used for preparing the land use /land cover map. ILWIS comprise a complete package of image processing, spatial analysis and digital mapping

TABLES

SCS model enables the hydrologist to stimulate the various design alternatives and compare the result. The parameter defined by land use allows the user to experiment with alternative forms of land development and management and to assess the impact of the proposed changes. The soil map of the study area was scanned and then registered with the help of geo-referenced SOI topographical map. The registered soil map was digitized, and different soil attributes were assigned to the different soil groups as described in Table 1

Group	Infiltration Rate (mm/hr)		Soil Texture
A	High	>25	Sand, Loamy sand, or Sandy loam
B	Moderate	12.5-25	Silt loam or loam
C	Low	2.5-12.5	Sandy clay loam
D	Very Low	<2.5	Clay loam, Silty clay loam, Sandy clay, Silty clay or clay

TABLE 1 : HYDROLOGIC SOIL GROUP

The AMC class was computed on the basis of five day accumulated moisture for the dormant and growing season separately. May, June, July, August, September, October and November were taken as growing periods whereas the rest of the months were considered as dormant periods. The AMC class for dormant and growing seasons presented in Table 2 and were used in the present study.

AMC-Class	Dormant season(mm)	Growing Season	Condition
I	< 12.7	<35.6	Dry soil but not the wilting point

II	12.7-27.9	35.6-53.3	Average conditions
III	>27.9	>53.3	Saturated soils, heavy rainfall or light rainfall

TABLE 2: ANTECEDENT MOISTURE CONDITION CLASSES

Land Use The variation of CN under AMC-II, called CNII, for various land use conditions commonly found in practice are shown in table 3.1,3.2 and 3.3.

Land	Cover		Hydrologic soil group			
	Treatment or Practice	Hydrologic condition	A	B	C	D
Cultivated	Straight row		76	86	90	93
Cultivated	Contoured	Poor	70	79	84	88
		Good	65	75	82	86
Cultivated	Contoured &	Poor	66	74	80	82
	Terraced	Good	62	71	77	81
Cultivated	Bunded	Poor	67	75	81	83
		Good	59	69	76	79
Cultivated	Paddy		95	95	95	95
Orchards	With understory cover		39	53	67	71
	Without understory cover		41	55	69	73
Forest	Dense		26	40	58	61
	Open		28	44	60	64
	Scrub		33	47	64	67
Pasture	Poor		68	79	86	89
	Fair		49	69	79	84
	Good		39	61	74	80
Wasteland			71	80	85	88
Roads(dirt)			73	83	88	90
Hard Surface			77	86	91	93

area					

Table 3.1: Runoff Curve Numbers [CNII] for Hydrologic Soil Cover Complex [Under AMC-II Conditions]

Cover and treatment	Hydrologic soil Group			
	A	B	C	D
Limited cover, Straight Row	67	78	85	89
Partial cover, Straight row	49	69	79	84
Complete cover, Straight row	39	61	74	80
Limited cover,contoured	65	75	82	86
Partial cover,contoured	25	59	45	83
Complete cover,contoured	6	35	70	79

Table 3.2: CNII Values for Sugarcane

Cover and Treatment	Hydrologic soil Group			
	A	B	C	D
Open spaces, lawns,parks etc (i) In good condition, grass cover in more than 75% area	39	61	74	80
(ii) In fair condition, grass cover on 50 to 75% area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial Districts(72% impervious))	81	88	91	93
Residential,average 65% impervious	77	85	90	92
Paved parking lots,paved roads with curbs,roofs,driveways,etc	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89

Table 3.3: Value for Suburban and Land Uses

SOLVING EXAMPLE

Example : A small watershed is 250ha in size and has group C soil. The land cover can be classified as 30% open forest and 70% poor quality pasture. Assuming AMC at average condition and the soil to be black soil, estimate the direct runoff volume due to rainfall of 75mm in one day.

manually solving:

AMC=II, Hence CN= CN(II). Soil= Black soil. Referring to table(3.1) for C-group soil

Land use	%	CN	Product
Open forest	30	60	1800
Pasture poor	70	86	6020
Total	**100**		**7820**

Average CN=7820/100 = 78.2 S=(25400/78.2)-254 = 70.81

The relevant runoff equation for black soil and AMC-II is

$$Q = \frac{(P-0.1S)^2}{P+0.9S} = \frac{[75-(0.1\times 70.81)]^2}{75+(0.9\times 70.81)} = 33.25 \text{ mm}$$

Total runoff volume over the catchment

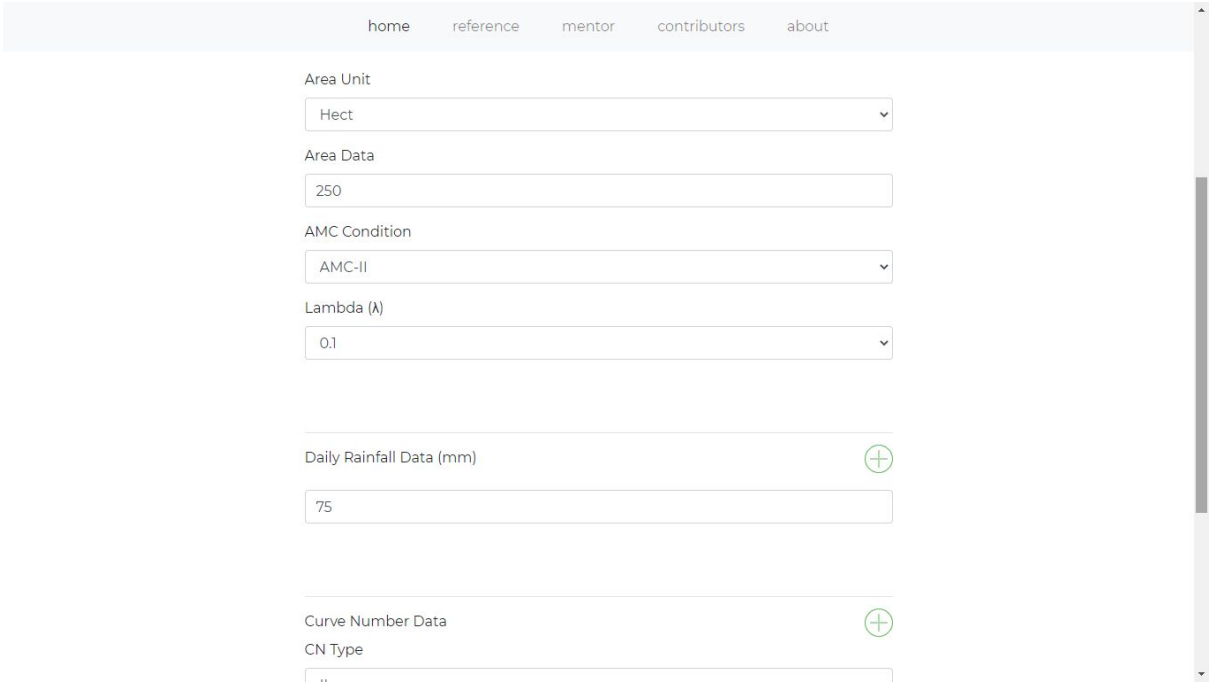
$$Vr = 250 \times 10000 \times 33.25/(1000) = \mathbf{83{,}125}\ m^3$$

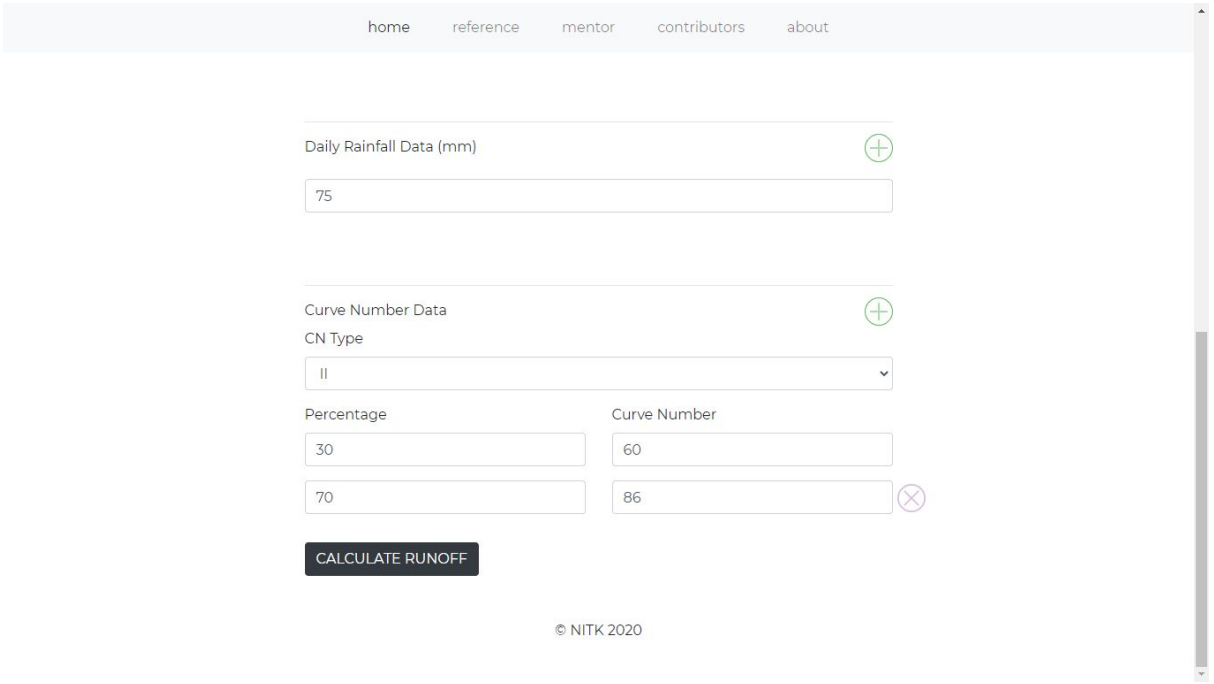
Solving with web application:

Giving all required data to the web application

- Data Includes
  - Daily rainfall data (in mm)
  - Unit of area
  - Value of area
  - AMC type (the value you want at the end of calculation)
  - Lambda
  - CN type (type of CN input you are giving)
  - CN percentage (percentage of particular CN)
  - CN value (value of that percentage of CN)

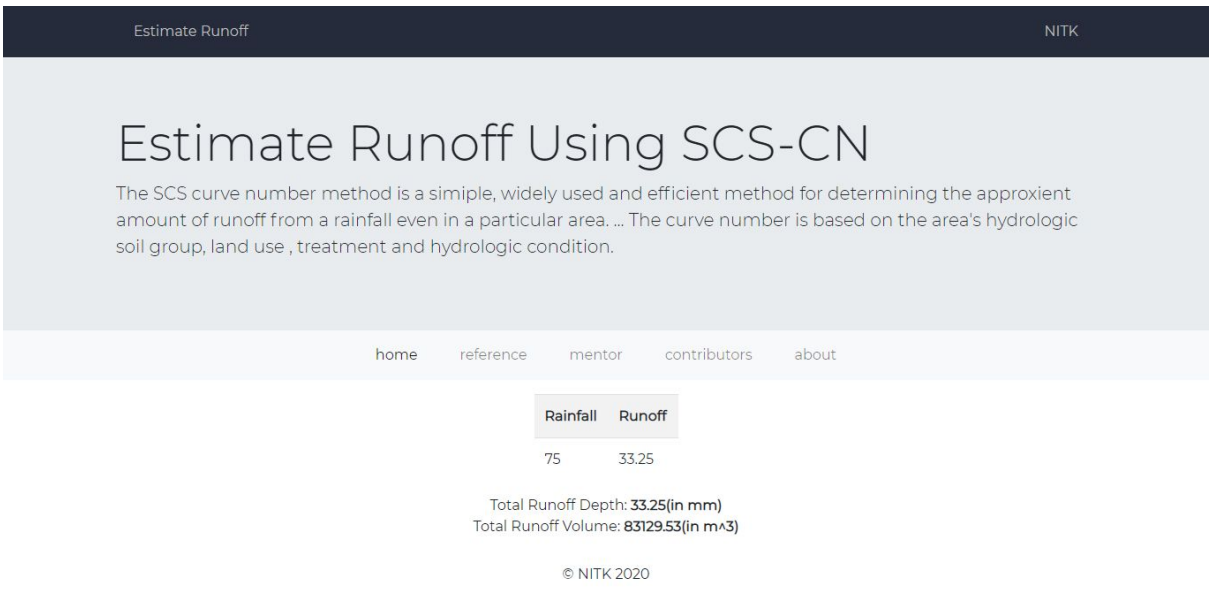
and then click **CALCULATE RUNOFF**.



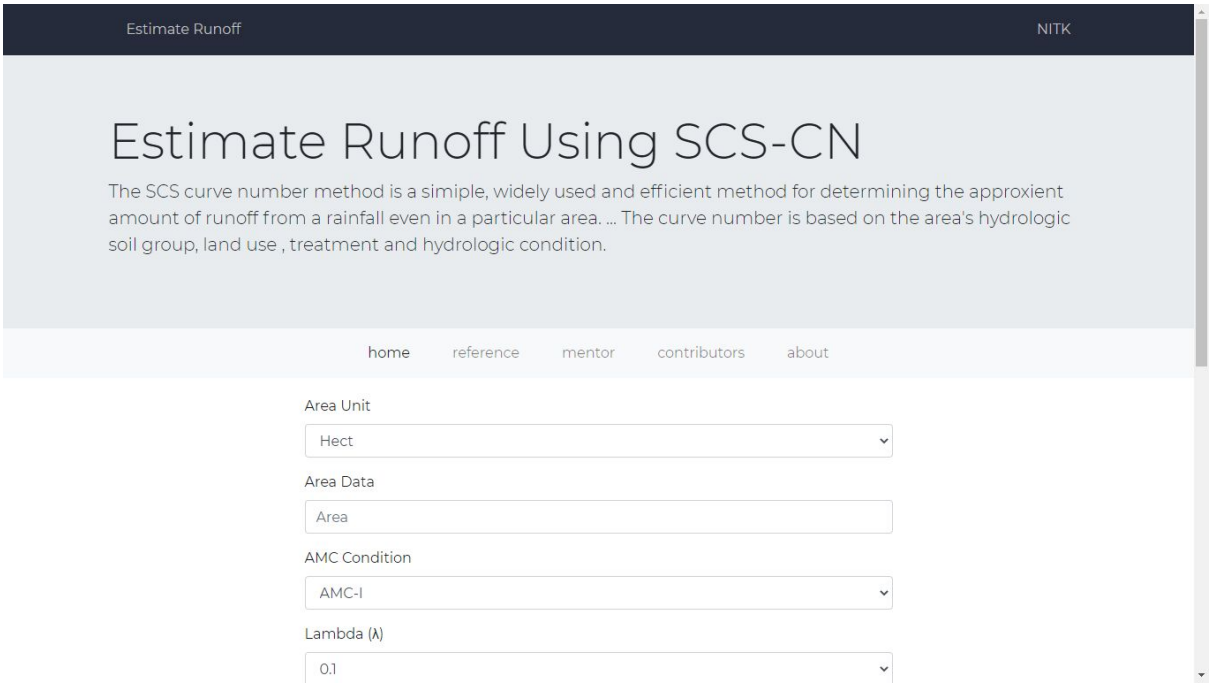


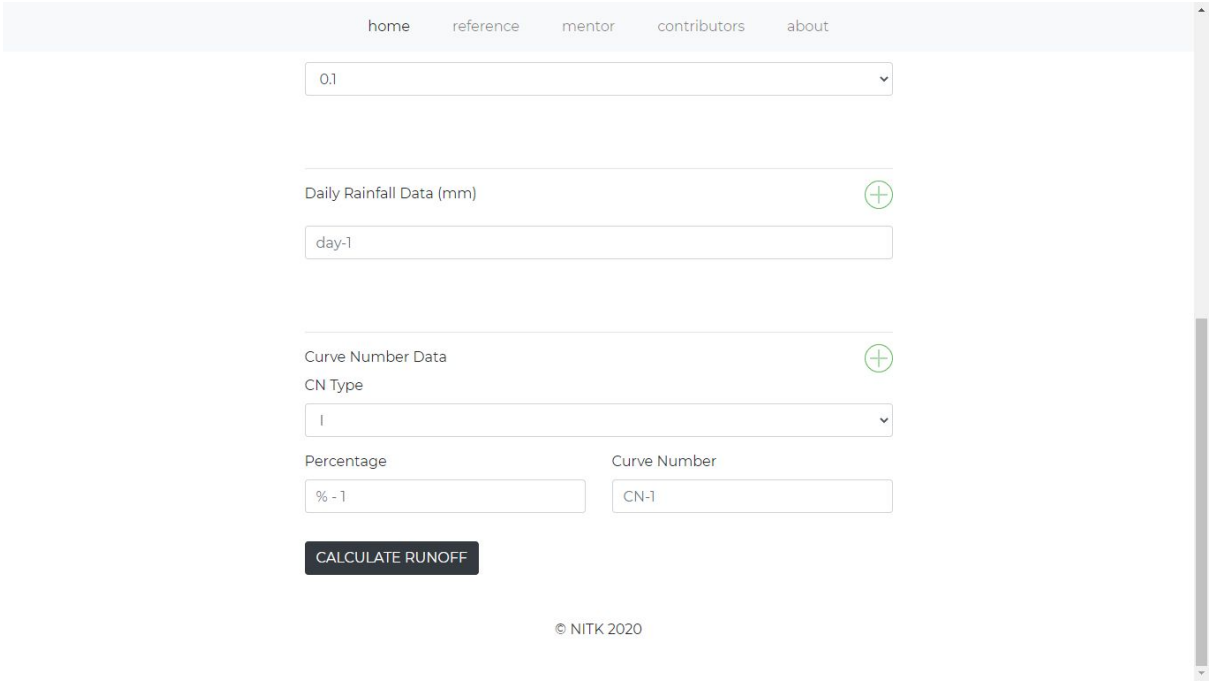
RESULT OF ABOVE INPUT FORM WEB APPLICATION

- Result includes
  - Daily runoff
  - Depth of Total runoff
  - Volume of Total runoff

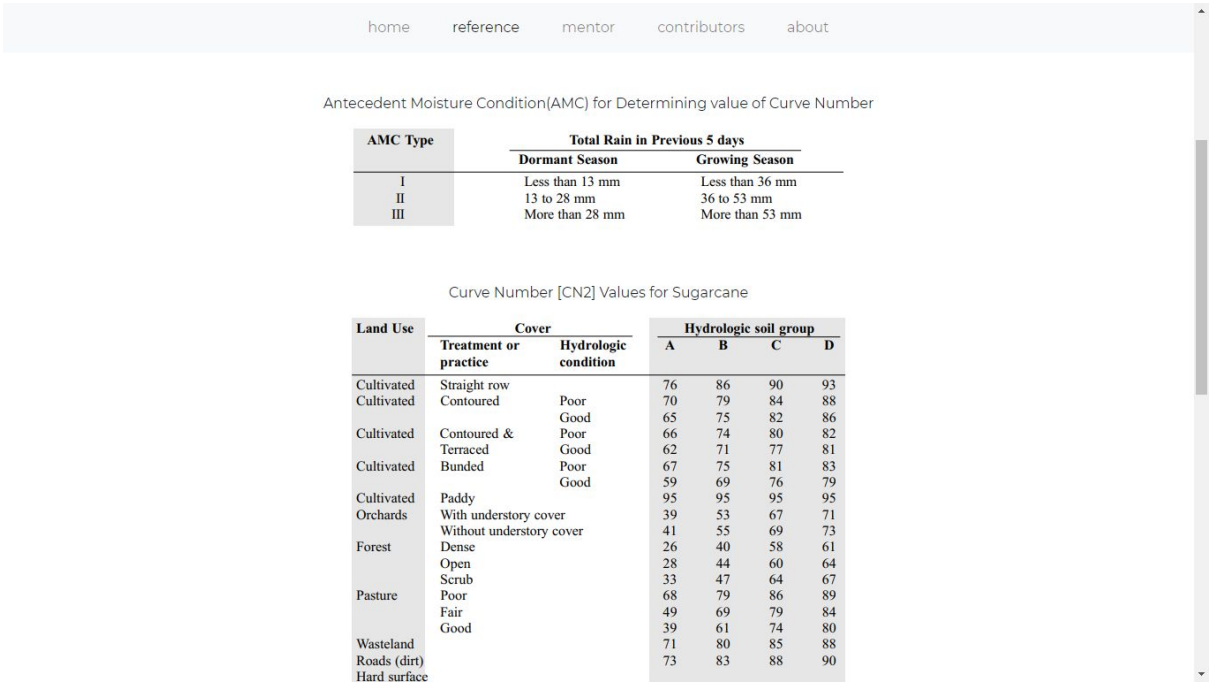


User Interface component/features of web application Screenshots





Reference tab for problems with soil group and land use



home reference mentor contributors about

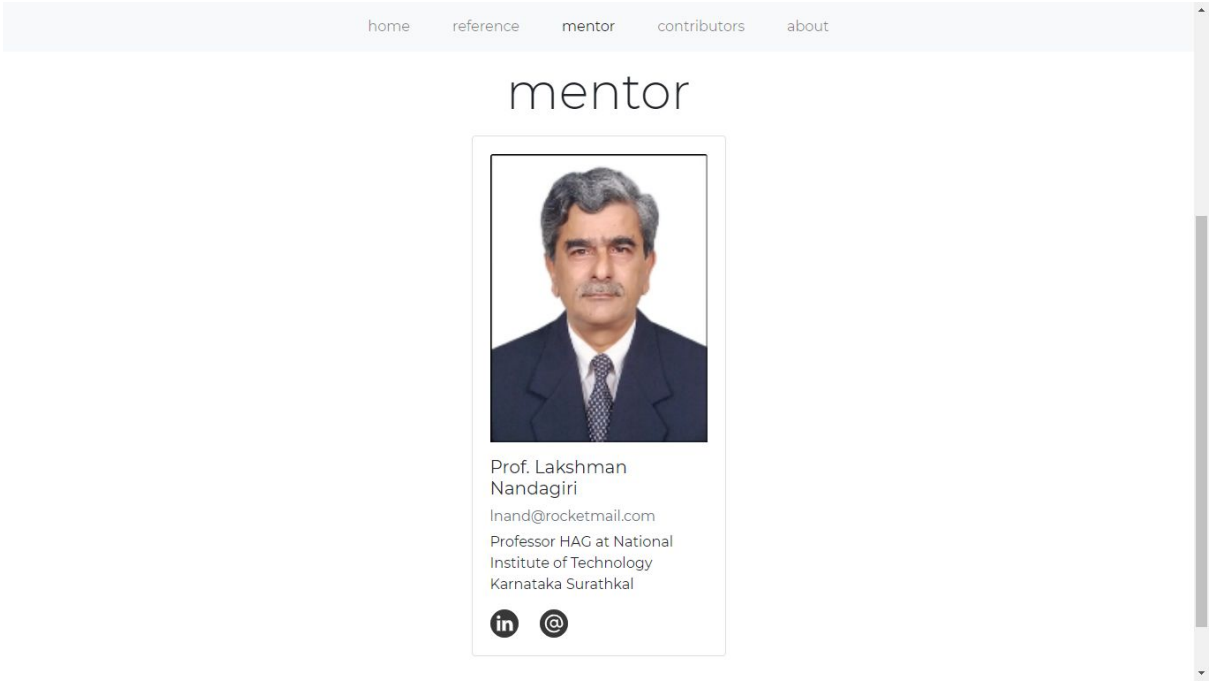
Antecedent Moisture Condition(AMC) for Determining value of Curve Number

AMC Type	Total Rain in Previous 5 days	
	Dormant Season	Growing Season
I	Less than 13 mm	Less than 36 mm
II	13 to 28 mm	36 to 53 mm
III	More than 28 mm	More than 53 mm

Curve Number [CN2] Values for Sugarcane

Land Use	Cover		Hydrologic soil group			
	Treatment or practice	Hydrologic condition	A	B	C	D
Cultivated	Straight row		76	86	90	93
Cultivated	Contoured	Poor	70	79	84	88
		Good	65	75	82	86
Cultivated	Contoured & Terraced	Poor	66	74	80	82
		Good	62	71	77	81
Cultivated	Bunded	Poor	67	75	81	83
		Good	59	69	76	79
Cultivated	Paddy		95	95	95	95
Orchards	With understory cover		39	53	67	71
	Without understory cover		41	55	69	73
Forest	Dense		26	40	58	61
	Open		28	44	60	64
	Scrub		33	47	64	67
Pasture	Poor		68	79	86	89
	Fair		49	69	79	84
	Good		39	61	74	80
Wasteland			71	80	85	88
Roads (dirt)			73	83	88	90
Hard surface						

mentor



home reference mentor contributors about

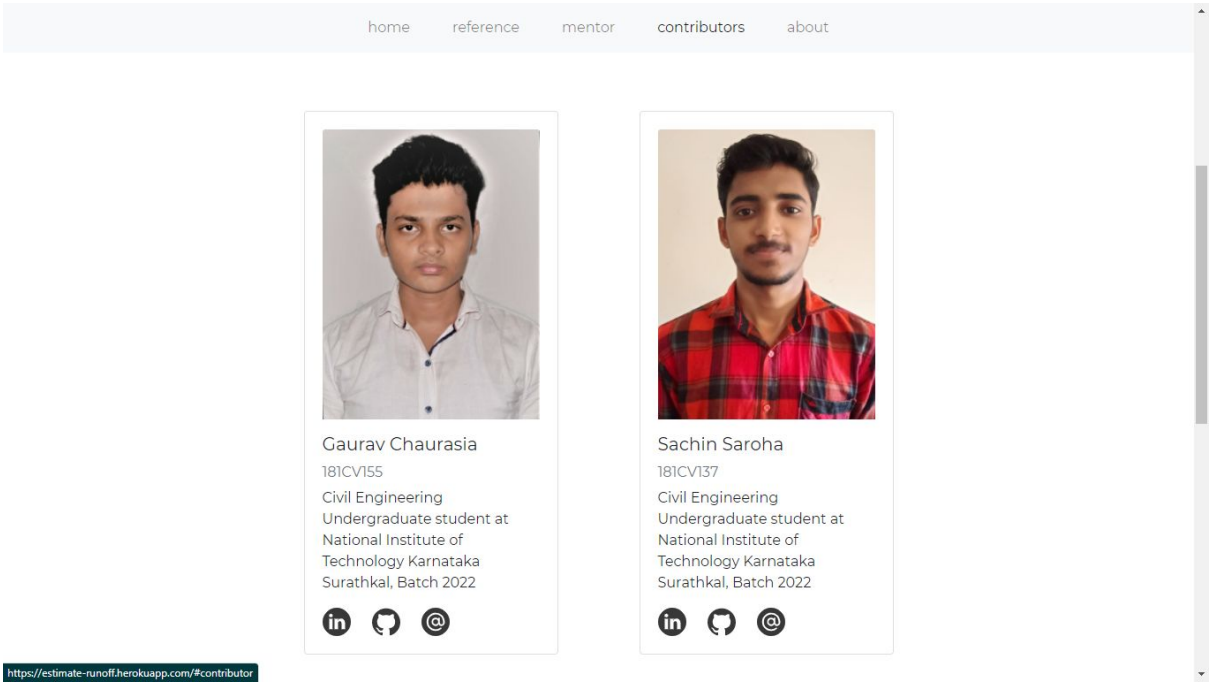
mentor

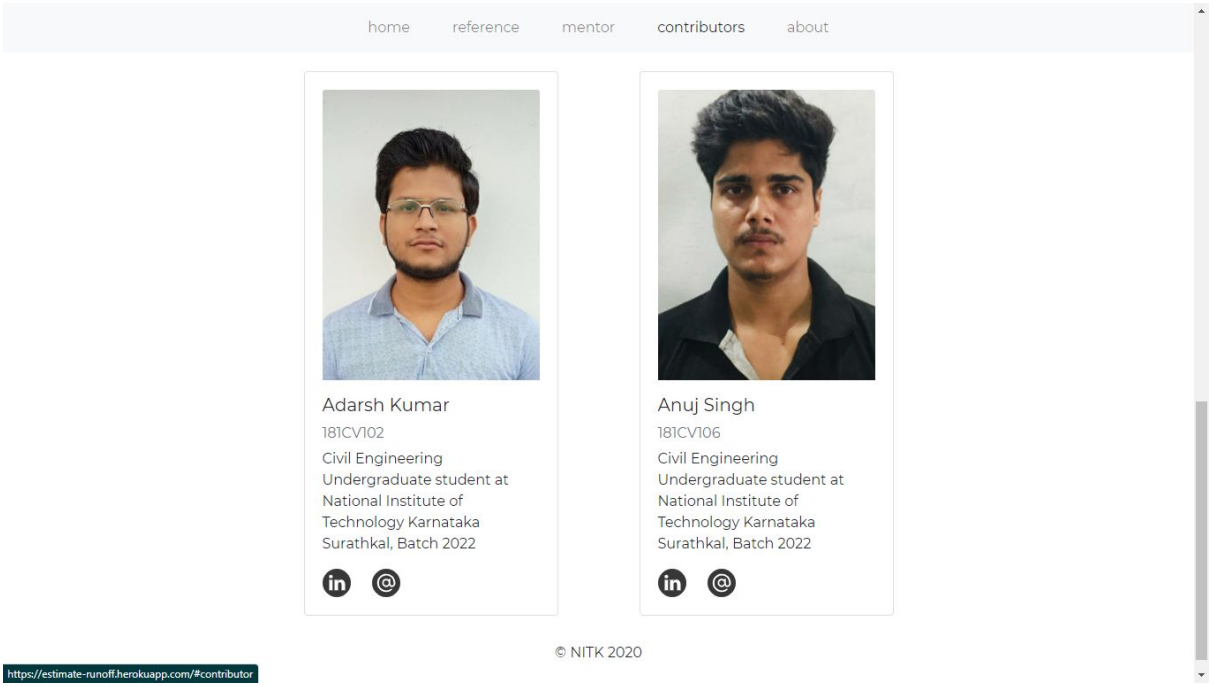
Prof. Lakshman Nandagiri

lnand@rocketmail.com

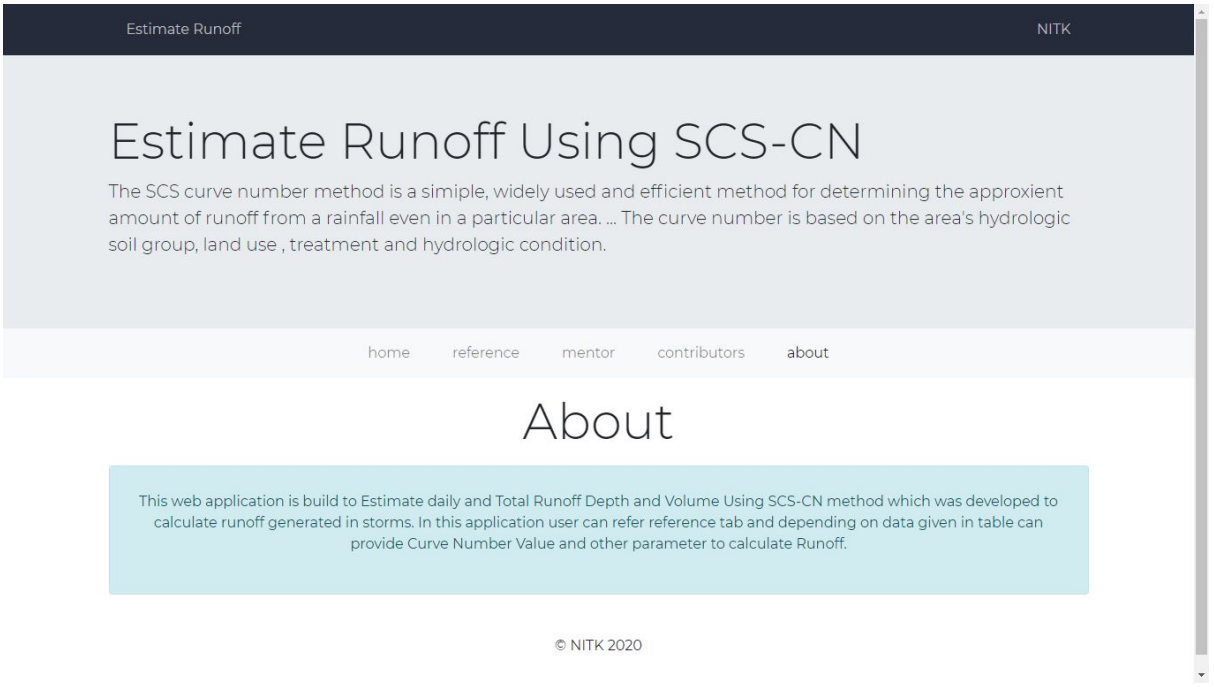
Professor HAG at National Institute of Technology Karnataka Surathkal

Contributors





About



- Links
  - Application is hosted on below link
    - https://estimate-runoff.herokuapp.com/
  - Complete code for this application is available on below link
    - https://github.com/sachin-saroha/estimate-runoff
    - https://github.com/gaurav-chaurasia/estimate-runoff

CONCLUSION

The present work that we did in this mini project automates the process of calculating / estimating the runoff during storm or normal rainfall. The SCS method originally was developed for agricultural watersheds in the mid-western United States; however it has been used throughout the world far beyond its original developers would have imagined.
The possibility of occurrence of flood during heavy rainfall event can be checked using SCS-CN method. Conducting study on account of possibility of changes in the Land use & Land cover and checking the return period of the peak runoff would help in taking measure for the safety of the crops and properties of the adjacent land. Further, study also reveals that improper maintenance of public utilities such as roads and drainage may likely trigger the possibility of the occurrence of flood. Hence every measure shall be taken to cease the urbanization and encourage for sustainable development

REFERENCE

- Referred Book is available on below url
  - https://www.pdfdrive.com/engineering-hydrology-e177545096.html
- https://getbootstrap.com/

ANNEXURE-I

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta name="viewport" content="width=device-width,
initial-scale=1.0" />
    <title>Estimate Runoff</title>
    <link rel="shortcut icon" href="./assets/favicon.svg"
type="image/x-icon" />
    <!-- CSS -->
    <link
      rel="stylesheet"

href="https://cdn.jsdelivr.net/npm/bootstrap@4.5.3/dist/css/bootst
rap.min.css"

integrity="sha384-TX8t27EcRE3e/ihU7zmQxVncDAy5uIKz4rEkgIXeMed4M0jl
fIDPvg6uqKI2xXr2"
      crossorigin="anonymous"
    />
    <link

href="https://fonts.googleapis.com/css2?family=Montserrat:wght@300
;400&display=swap"
      rel="stylesheet"
    />
    <link rel="stylesheet" href="./css/style.css" />
  </head>
  <body>
    <nav class="navbar nav">
      <div class="container">
        <ul class="navbar-nav">
          <li class="nav-item">
            <a class="nav-link logo" href="/">Estimate Runoff</a>
```

```
          </li>
        </ul>
        <ul class="navbar-nav">
          <li class="nav-item">
            <a
              class="nav-link logo"
              target="_blank"
              href="https://www.nitk.ac.in/"
              >NITK</a
            >
          </li>
        </ul>
      </div>
    </nav>
    <div class="jumbotron jumbotron-fluid" style="margin-bottom:
0">
      <div class="container">
        <h1 class="display-4">Estimate Runoff Using SCS-CN</h1>
        <p class="lead">
          The SCS curve number method is a simiple, widely used
and efficient
          method for determining the approxient amount of runoff
from a rainfall
          even in a particular area. ... The curve number is based
on the area's
          hydrologic soil group, land use , treatment and
hydrologic condition.
        </p>
      </div>
    </div>
    <nav class="navbar navi navbar-expand-sm bg-light
navbar-light">
      <button
        class="navbar-toggler"
        type="button"
        data-toggle="collapse"
        data-target="#navbarSupportedContent"
        aria-controls="navbarSupportedContent"
        aria-expanded="false"
        aria-label="Toggle navigation"
      >
        <span class="navbar-toggler-icon"></span>
```

```
      </button>
      <div class="collapse navbar-collapse"
id="navbarSupportedContent">
        <div class="container">
          <ul class="navbar-nav"></ul>
          <ul class="navbar-nav noob">
            <li class="nav-item">
              <a class="nav-link mx-3 active" data-toggle="tab"
href="#form"
                >home</a
              >
            </li>
            <li class="nav-item">
              <a class="nav-link mx-3" data-toggle="tab"
href="#reference"
                >reference</a
              >
            </li>
            <li class="nav-item">
              <a class="nav-link mx-3" data-toggle="tab"
href="#guied"
                >mentor</a
              >
            </li>
            <li class="nav-item">
              <a class="nav-link mx-3" data-toggle="tab"
href="#contributor"
                >contributors</a
              >
            </li>
            <li class="nav-item">
              <a class="nav-link mx-3" data-toggle="tab"
href="#about">about</a>
            </li>
          </ul>
          <ul class="navbar-nav"></ul>
        </div>
      </div>
    </nav>

    <div class="container tab-content">
      <div
```

```
          class="tab-pane fade show active"
          id="form"
          role="tabpanel"
          aria-labelledby="nav-home-tab"
        >
          <form class="form">
            <div class="form-group">
              <label for="AMC">Area Unit</label>
              <select class="form-control area-unit">
                <option value="1">Hect</option>
                <option value="2">Meter*Meter</option>
              </select>
            </div>
            <div class="form-group">
              <label for="area-data">Area Data</label>
              <input
                class="form-control area-data mb-3"
                placeholder="Area"
                type="number"
              />
            </div>
            <div class="form-group">
              <label for="AMC">AMC Condition</label>
              <select class="form-control AMC" name="AMC">
                <option value="1">AMC-I</option>
                <option value="2">AMC-II</option>
                <option value="3">AMC-III</option>
              </select>
            </div>
            <div class="form-group">
              <label for="lambda">Lambda ( λ )</label>
              <select class="form-control lambda" name="lambda"
id="">
                <option value="0.1">0.1</option>
                <option value="0.2">0.2</option>
                <option value="0.3">0.3</option>
              </select>
            </div>
            <div class="seperator"></div>
            <hr />
            <div class="form-group">
              <div class="input_rain_wrap">
```

```
              <label for="username">Daily Rainfall Data
(mm)</label>
              <button class="add_rain_button my-3">
                <svg
                  version="1.1"
                  id="Capa_1"
                  xmlns="http://www.w3.org/2000/svg"
                  xmlns:xlink="http://www.w3.org/1999/xlink"
                  x="0px"
                  y="0px"
                  viewBox="0 0 496 496"
                  style="enable-background: new 0 0 496 496"
                  xml:space="preserve"
                >
                  <g>
                    <path

d="M248,0C111.033,0,0,111.033,0,248c0.154,136.903,111.097,247.846,
248,248c136.967,0,248-111.033,248-248S384.967,0,248,0
            z
M248,480C119.87,480,16,376.13,16,248C16.146,119.93,119.93,16.146,2
48,16c128.13,0,232,103.87,232,232S376.13,480,248,480z"
                    />
                    <path

d="M400,240H256V96c0-4.418-3.582-8-8-8s-8,3.582-8,8v144H96c-4.418,
0-8,3.582-8,8s3.582,8,8,8h144v144c0,4.418,3.582,8,8,8

s8-3.582,8-8V256h144c4.418,0,8-3.582,8-8S404.418,240,400,240z"
                    />
                  </g>
                </svg>
              </button>
              <div>
                <input
                  class="form-control rain-data my-3"
                  min="0"
                  placeholder="day-1"
                  type="number"
                  name="rain[]"
                />
              </div>
```

```
        </div>
      </div>

      <div class="seperator"></div>
      <hr />
      <div class="form-group">
        <div class="input_cn_wrap">
          <label for="CN">Curve Number Data</label>
          <button class="add_cn_button my-3">
            <svg
              version="1.1"
              id="Capa_1"
              xmlns="http://www.w3.org/2000/svg"
              xmlns:xlink="http://www.w3.org/1999/xlink"
              x="0px"
              y="0px"
              viewBox="0 0 496 496"
              style="enable-background: new 0 0 496 496"
              xml:space="preserve"
            >
              <g>
                <path

d="M248,0C111.033,0,0,111.033,0,248c0.154,136.903,111.097,247.846,
248,248c136.967,0,248-111.033,248-248S384.967,0,248,0
                    z
M248,480C119.87,480,16,376.13,16,248C16.146,119.93,119.93,16.146,2
48,16c128.13,0,232,103.87,232,232S376.13,480,248,480z"
                />
                <path

d="M400,240H256V96c0-4.418-3.582-8-8-8s-8,3.582-8,8v144H96c-4.418,
0-8,3.582-8,8s3.582,8,8,8h144v144c0,4.418,3.582,8,8,8

s8-3.582,8-8V256h144c4.418,0,8-3.582,8-8S404.418,240,400,240z"
                />
              </g>
            </svg>
          </button>
          <div class="form-group">
            <label for="CNType">CN Type</label>
            <select class="form-control CNType" name="CNType"
```

```
id="">
                  <option value="1">I</option>
                  <option value="2">II</option>
                  <option value="3">III</option>
                </select>
              </div>
              <div class="row">
                <div class="col-6">
                  <label for="contribution">Percentage</label>
                  <input
                    class="form-control cn-p mb-3"
                    placeholder="% - 1"
                    type="number"
                    name="contribution[]"
                  />
                </div>
                <div class="col-6">
                  <label for="cn">Curve Number</label>
                  <input
                    class="form-control cn-v mb-3"
                    placeholder="CN-1"
                    type="number"
                    name="cn[]"
                  />
                </div>
              </div>
            </div>
          </div>
          <button class="btn btn-dark calculate">Calculate
Runoff</button>
        </form>
      </div>

      <div
        class="tab-pane fade"
        id="reference"
        role="tabpanel"
        aria-labelledby="nav-profile-tab"
      >
        <div class="container my-3">
          <div class="center-xy my-3">
            <div class="my-3">
```

```
              Antecedent Moisture Condition(AMC) for Determining
value of Curve
              Number
            </div>
            <img
              src="./assets/AMC.png"
              class="img-fluid"
              alt="Responsive image"
            />
          </div>
        </div>
        <div class="container my-3">
          <div class="center-xy my-3">
            <div class="my-3">Curve Number [CN2] Values for
Sugarcane</div>
            <img
              src="./assets/a.png"
              class="img-fluid"
              alt="Responsive image"
            />
          </div>
        </div>
        <div class="container my-3">
          <div class="center-xy my-3">
            <div class="my-3">
              Curve Number [CN2] Values for Sugarcane and Urban
Land Use
            </div>
            <img
              src="./assets/b.png"
              class="img-fluid"
              alt="Responsive image"
            />
          </div>
        </div>
        <div class="container my-3">
          <div class="center-xy my-3">
            <div class="my-3">
              Runoff Curve Number [CN2] for Hydrologic Soil Cover
Complexes
              [Under AMC-II Conditions]
            </div>
```

```
            <img
              src="./assets/c.png"
              class="img-fluid"
              alt="Responsive image"
            />
          </div>
        </div>
      </div>

      <div
        class="tab-pane fade"
        id="about"
        role="tabpanel"
        aria-labelledby="nav-profile-tab"
      >
        <div class="display-4 center my-3">About</div>
        <div class="alert alert-info my-3" role="alert">
          <div class="center-xy my-3">
            <!-- <h4 class="alert-heading">Estimate Runoff</h4>
-->
            <p class="center">
              This web application is build to Estimate daily and
Total Runoff
              Depth and Volume Using SCS-CN method which was
developed to
              calculate runoff generated in storms. In this
application user can
              refer reference tab and depending on data given in
table can
              provide Curve Number Value and other parameter to
calculate
              Runoff.
            </p>
          </div>
        </div>
      </div>

      <div
        class="tab-pane fade"
        id="contributor"
        role="tabpanel"
        aria-labelledby="nav-profile-tab"
```

```
      >
        <div class="display-4 center my-3">Contributors</div>
        <div class="row justify-content-center">
          <div class="col-md-4">
            <div class="card" style="width: 18rem">
              <div class="card-body">
                <img
                  class="card-img-top"
                  src="./assets/img/gaurav.jpeg"
                  alt="Gaurav Chaurasia"
                />
                <h5 class="card-title my-3">Gaurav Chaurasia</h5>
                <h6 class="card-subtitle mb-2
text-muted">181CV155</h6>
                <p class="card-text">
                  Civil Engineering Undergraduate student at
National Institute
                  of Technology Karnataka Surathkal, Batch 2022
                </p>
                <a

href="https://www.linkedin.com/in/gaurav-chaurasia/"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    class="linkedin"
                    height="512pt"
                    viewBox="0 0 512 512"
                    width="512pt"
                  >
                    <path
                      d="m256 0c-141.363281 0-256 114.636719-256
256s114.636719 256 256 256 256-114.636719
256-256-114.636719-256-256-256zm-74.390625
387h-62.347656v-187.574219h62.347656zm-31.171875-213.1875h-.40625c
-20.921875 0-34.453125-14.402344-34.453125-32.402344 0-18.40625
13.945313-32.410156 35.273437-32.410156 21.328126 0 34.453126
14.003906 34.859376 32.410156 0 18-13.53125 32.402344-35.273438
32.402344zm255.984375
213.1875h-62.339844v-100.347656c0-25.21875-9.027343-42.417969-31.5
85937-42.417969-17.222656 0-27.480469 11.601563-31.988282
```

```
22.800781-1.648437 4.007813-2.050781 9.609375-2.050781
15.214844v104.75h-62.34375s.816407-169.976562
0-187.574219h62.34375v26.558594c8.285157-12.78125
23.109375-30.960937 56.1875-30.960937 41.019531 0 71.777344
26.808593 71.777344 84.421874zm0 0"
                    />
                  </svg>
                </a>
                <a
                  href="https://github.com/gaurav-chaurasia/"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    class="github"
                    height="512pt"
                    viewBox="0 0 24 24"
                    width="512pt"
                  >
                    <path
                      d="m12 .5c-6.63 0-12 5.28-12 11.792 0 5.211
3.438 9.63 8.205 11.188.6.111.82-.254.82-.567
0-.28-.01-1.022-.015-2.005-3.338.711-4.042-1.582-4.042-1.582-.546-
1.361-1.335-1.725-1.335-1.725-1.087-.731.084-.716.084-.716
1.205.082 1.838 1.215 1.838 1.215 1.07 1.803 2.809 1.282
3.495.981.108-.763.417-1.282.76-1.577-2.665-.295-5.466-1.309-5.466
-5.827 0-1.287.465-2.339 1.235-3.164-.135-.298-.54-1.497.105-3.121
0 0 1.005-.316 3.3 1.209.96-.262 1.98-.392 3-.398 1.02.006
2.04.136 3 .398 2.28-1.525 3.285-1.209 3.285-1.209.645 1.624.24
2.823.12 3.121.765.825 1.23 1.877 1.23 3.164 0 4.53-2.805
5.527-5.475 5.817.42.354.81 1.077.81 2.182 0 1.578-.015 2.846-.015
3.229 0 .309.21.678.825.56 4.801-1.548 8.236-5.97 8.236-11.173
0-6.512-5.373-11.792-12-11.792z"
                    />
                  </svg>
                </a>
                <a
                  href="mailto:gaurav.181cv155@nitk.edu.in"
                  class="card-link"
                  target="_blank"
                >
                  <svg
```

```
                    version="1.1"
                    id="Capa_1"
                    xmlns="http://www.w3.org/2000/svg"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    x="0px"
                    y="0px"
                    viewBox="0 0 512 512"
                    style="enable-background: new 0 0 512 512"
                    xml:space="preserve"
                  >
                    <g>
                      <path

d="M257,210c-24.814,0-45,20.186-45,45c0,24.814,20.186,45,45,45c24.
814,0,45-20.186,45-45C302,230.186,281.814,210,257,210z"
                      />
                    </g>
                    <g>
                      <path

d="M255,0C114.39,0,0,114.39,0,255s114.39,257,255,257s257-116.39,25
7-257S395.61,0,255,0z M362,330

c-20.273,0-38.152-10.161-49.017-25.596C299.23,319.971,279.354,330,
257,330c-41.353,0-75-33.647-75-75c0-41.353,33.647-75,75-75

c16.948,0,32.426,5.865,45,15.383V195c0-8.291,6.709-15,15-15c8.291,
0,15,6.709,15,15c0,33.36,0,41.625,0,75

c0,16.538,13.462,30,30,30c16.538,0,30-13.462,30-30c0-100.391-66.43
2-150-135-150c-74.443,0-135,60.557-135,135

s60.557,135,135,135c30,0,58.374-9.609,82.061-27.803c15.822-12.078,
33.94,11.765,18.281,23.789

C328.353,408.237,293.665,420,257,420c-90.981,0-165-74.019-165-165S
166.019,90,257,90c82.897,0,165,61.135,165,180
                  C422,303.091,395.091,330,362,330z"
                      />
                    </g>
                  </svg>
                </a>
```

```
            </div>
          </div>
        </div>
        <div class="col-md-4">
          <div class="card" style="width: 18rem">
            <div class="card-body">
              <img
                class="card-img-top"
                src="./assets/img/sachin.jpeg"
                alt="sachin saroha"
              />
              <h5 class="card-title my-3">Sachin Saroha</h5>
              <h6 class="card-subtitle mb-2
text-muted">181CV137</h6>
              <p class="card-text">
                Civil Engineering Undergraduate student at
National Institute
                of Technology Karnataka Surathkal, Batch 2022
              </p>
              <a

href="https://www.linkedin.com/in/sachin-saroha/"
                class="card-link"
                target="_blank"
              >
                <svg
                  class="linkedin"
                  height="512pt"
                  viewBox="0 0 512 512"
                  width="512pt"
                >
                  <path
                    d="m256 0c-141.363281 0-256 114.636719-256
256s114.636719 256 256 256 256-114.636719
256-256-114.636719-256-256-256zm-74.390625
387h-62.347656v-187.574219h62.347656zm-31.171875-213.1875h-.40625c
-20.921875 0-34.453125-14.402344-34.453125-32.402344 0-18.40625
13.945313-32.410156 35.273437-32.410156 21.328126 0 34.453126
14.003906 34.859376 32.410156 0 18-13.53125 32.402344-35.273438
32.402344zm255.984375
213.1875h-62.339844v-100.347656c0-25.21875-9.027343-42.417969-31.5
85937-42.417969-17.222656 0-27.480469 11.601563-31.988282
```

```
22.800781-1.648437 4.007813-2.050781 9.609375-2.050781
15.214844v104.75h-62.34375s.816407-169.976562
0-187.574219h62.34375v26.558594c8.285157-12.78125
23.109375-30.960937 56.1875-30.960937 41.019531 0 71.777344
26.808593 71.777344 84.421874zm0 0"
                    />
                  </svg>
                </a>
                <a
                  href="https://github.com/sachin-saroha/"
                  target="_blank"
                  class="card-link"
                >
                  <svg
                    class="github"
                    height="512pt"
                    viewBox="0 0 24 24"
                    width="512pt"
                  >
                    <path
                      d="m12 .5c-6.63 0-12 5.28-12 11.792 0 5.211
3.438 9.63 8.205 11.188.6.111.82-.254.82-.567
0-.28-.01-1.022-.015-2.005-3.338.711-4.042-1.582-4.042-1.582-.546-
1.361-1.335-1.725-1.335-1.725-1.087-.731.084-.716.084-.716
1.205.082 1.838 1.215 1.838 1.215 1.07 1.803 2.809 1.282
3.495.981.108-.763.417-1.282.76-1.577-2.665-.295-5.466-1.309-5.466
-5.827 0-1.287.465-2.339 1.235-3.164-.135-.298-.54-1.497.105-3.121
0 0 1.005-.316 3.3 1.209.96-.262 1.98-.392 3-.398 1.02.006
2.04.136 3 .398 2.28-1.525 3.285-1.209 3.285-1.209.645 1.624.24
2.823.12 3.121.765.825 1.23 1.877 1.23 3.164 0 4.53-2.805
5.527-5.475 5.817.42.354.81 1.077.81 2.182 0 1.578-.015 2.846-.015
3.229 0 .309.21.678.825.56 4.801-1.548 8.236-5.97 8.236-11.173
0-6.512-5.373-11.792-12-11.792z"
                    />
                  </svg>
                </a>
                <a
                  href="mailto:sachinsaroha.181cv137@nitk.edu.in"
                  class="card-link"
                  target="_blank"
                >
                  <svg
```

```
                    version="1.1"
                    id="Capa_1"
                    xmlns="http://www.w3.org/2000/svg"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    x="0px"
                    y="0px"
                    viewBox="0 0 512 512"
                    style="enable-background: new 0 0 512 512"
                    xml:space="preserve"
                  >
                    <g>
                      <path

d="M257,210c-24.814,0-45,20.186-45,45c0,24.814,20.186,45,45,45c24.
814,0,45-20.186,45-45C302,230.186,281.814,210,257,210z"
                      />
                    </g>
                    <g>
                      <path

d="M255,0C114.39,0,0,114.39,0,255s114.39,257,255,257s257-116.39,25
7-257S395.61,0,255,0z M362,330

c-20.273,0-38.152-10.161-49.017-25.596C299.23,319.971,279.354,330,
257,330c-41.353,0-75-33.647-75-75c0-41.353,33.647-75,75-75

c16.948,0,32.426,5.865,45,15.383V195c0-8.291,6.709-15,15-15c8.291,
0,15,6.709,15,15c0,33.36,0,41.625,0,75

c0,16.538,13.462,30,30,30c16.538,0,30-13.462,30-30c0-100.391-66.43
2-150-135-150c-74.443,0-135,60.557-135,135

s60.557,135,135,135c30,0,58.374-9.609,82.061-27.803c15.822-12.078,
33.94,11.765,18.281,23.789

C328.353,408.237,293.665,420,257,420c-90.981,0-165-74.019-165-165S
166.019,90,257,90c82.897,0,165,61.135,165,180
                  C422,303.091,395.091,330,362,330z"
                      />
                    </g>
                  </svg>
                </a>
```

```
            </div>
          </div>
        </div>
      </div>
      <div class="row justify-content-center">
        <div class="col-md-4">
          <div class="card" style="width: 18rem">
            <div class="card-body">
              <img
                class="card-img-top"
                src="./assets/img/adarsh.jpeg"
                alt="Adarsh Kumar"
              />
              <h5 class="card-title my-3">Adarsh Kumar</h5>
              <h6 class="card-subtitle mb-2
text-muted">181CV102</h6>
              <p class="card-text">
                Civil Engineering Undergraduate student at
National Institute
                of Technology Karnataka Surathkal, Batch 2022
              </p>
              <a

href="https://www.linkedin.com/in/adarsh-kumar1523"
                class="card-link"
                target="_blank"
              >
                <svg
                  class="linkedin"
                  height="512pt"
                  viewBox="0 0 512 512"
                  width="512pt"
                >
                  <path
                    d="m256 0c-141.363281 0-256 114.636719-256
256s114.636719 256 256 256 256-114.636719
256-256-114.636719-256-256-256zm-74.390625
387h-62.347656v-187.574219h62.347656zm-31.171875-213.1875h-.40625c
-20.921875 0-34.453125-14.402344-34.453125-32.402344 0-18.40625
13.945313-32.410156 35.273437-32.410156 21.328126 0 34.453126
14.003906 34.859376 32.410156 0 18-13.53125 32.402344-35.273438
32.402344zm255.984375
```

```
213.1875h-62.339844v-100.347656c0-25.21875-9.027343-42.417969-31.5
85937-42.417969-17.222656 0-27.480469 11.601563-31.988282
22.800781-1.648437 4.007813-2.050781 9.609375-2.050781
15.214844v104.75h-62.34375s.816407-169.976562
0-187.574219h62.34375v26.558594c8.285157-12.78125
23.109375-30.960937 56.1875-30.960937 41.019531 0 71.777344
26.808593 71.777344 84.421874zm0 0"
                    />
                  </svg>
                </a>
                <a
                  href="mailto:adarshkumar.181cv102@nitk.edu.in"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    version="1.1"
                    id="Capa_1"
                    xmlns="http://www.w3.org/2000/svg"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    x="0px"
                    y="0px"
                    viewBox="0 0 512 512"
                    style="enable-background: new 0 0 512 512"
                    xml:space="preserve"
                  >
                    <g>
                      <path

d="M257,210c-24.814,0-45,20.186-45,45c0,24.814,20.186,45,45,45c24.
814,0,45-20.186,45-45C302,230.186,281.814,210,257,210z"
                        />
                    </g>
                    <g>
                      <path

d="M255,0C114.39,0,0,114.39,0,255s114.39,257,255,257s257-116.39,25
7-257S395.61,0,255,0z M362,330

c-20.273,0-38.152-10.161-49.017-25.596C299.23,319.971,279.354,330,
257,330c-41.353,0-75-33.647-75-75c0-41.353,33.647-75,75-75
```

```
c16.948,0,32.426,5.865,45,15.383V195c0-8.291,6.709-15,15-15c8.291,
0,15,6.709,15,15c0,33.36,0,41.625,0,75

c0,16.538,13.462,30,30,30c16.538,0,30-13.462,30-30c0-100.391-66.43
2-150-135-150c-74.443,0-135,60.557-135,135

s60.557,135,135,135c30,0,58.374-9.609,82.061-27.803c15.822-12.078,
33.94,11.765,18.281,23.789

C328.353,408.237,293.665,420,257,420c-90.981,0-165-74.019-165-165S
166.019,90,257,90c82.897,0,165,61.135,165,180
                C422,303.091,395.091,330,362,330z"
                    />
                  </g>
                </svg>
              </a>
            </div>
          </div>
        </div>
        <div class="col-md-4">
          <div class="card" style="width: 18rem">
            <div class="card-body">
              <img
                class="card-img-top"
                src="./assets/img/anuj.jpeg"
                alt="Anuj Singh"
              />
              <h5 class="card-title my-3">Anuj Singh</h5>
              <h6 class="card-subtitle mb-2
text-muted">181CV106</h6>
              <p class="card-text">
                Civil Engineering Undergraduate student at
National Institute
                of Technology Karnataka Surathkal, Batch 2022
              </p>
              <a
                href="https://www.linkedin.com/in/anuj-singh69"
                class="card-link"
                target="_blank"
              >
                <svg
                  class="linkedin"
```

```
                    height="512pt"
                    viewBox="0 0 512 512"
                    width="512pt"
                  >
                    <path
                      d="m256 0c-141.363281 0-256 114.636719-256
256s114.636719 256 256 256 256-114.636719
256-256-114.636719-256-256-256zm-74.390625
387h-62.347656v-187.574219h62.347656zm-31.171875-213.1875h-.40625c
-20.921875 0-34.453125-14.402344-34.453125-32.402344 0-18.40625
13.945313-32.410156 35.273437-32.410156 21.328126 0 34.453126
14.003906 34.859376 32.410156 0 18-13.53125 32.402344-35.273438
32.402344zm255.984375
213.1875h-62.339844v-100.347656c0-25.21875-9.027343-42.417969-31.5
85937-42.417969-17.222656 0-27.480469 11.601563-31.988282
22.800781-1.648437 4.007813-2.050781 9.609375-2.050781
15.214844v104.75h-62.34375s.816407-169.976562
0-187.574219h62.34375v26.558594c8.285157-12.78125
23.109375-30.960937 56.1875-30.960937 41.019531 0 71.777344
26.808593 71.777344 84.421874zm0 0"
                    />
                  </svg>
                </a>
                <a
                  href="mailto:anujkumar.181cv106@nitk.edu.in"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    version="1.1"
                    id="Capa_1"
                    xmlns="http://www.w3.org/2000/svg"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    x="0px"
                    y="0px"
                    viewBox="0 0 512 512"
                    style="enable-background: new 0 0 512 512"
                    xml:space="preserve"
                  >
                    <g>
                      <path
```

```
d="M257,210c-24.814,0-45,20.186-45,45c0,24.814,20.186,45,45,45c24.
814,0,45-20.186,45-45C302,230.186,281.814,210,257,210z"
                      />
                    </g>
                    <g>
                      <path

d="M255,0C114.39,0,0,114.39,0,255s114.39,257,255,257s257-116.39,25
7-257S395.61,0,255,0z M362,330

c-20.273,0-38.152-10.161-49.017-25.596C299.23,319.971,279.354,330,
257,330c-41.353,0-75-33.647-75-75c0-41.353,33.647-75,75-75

c16.948,0,32.426,5.865,45,15.383V195c0-8.291,6.709-15,15-15c8.291,
0,15,6.709,15,15c0,33.36,0,41.625,0,75

c0,16.538,13.462,30,30,30c16.538,0,30-13.462,30-30c0-100.391-66.43
2-150-135-150c-74.443,0-135,60.557-135,135

s60.557,135,135,135c30,0,58.374-9.609,82.061-27.803c15.822-12.078,
33.94,11.765,18.281,23.789

C328.353,408.237,293.665,420,257,420c-90.981,0-165-74.019-165-165S
166.019,90,257,90c82.897,0,165,61.135,165,180
                C422,303.091,395.091,330,362,330z"
                      />
                    </g>
                  </svg>
                </a>
              </div>
            </div>
          </div>
        </div>
      </div>

      <div
        class="tab-pane fade"
        id="guied"
        role="tabpanel"
        aria-labelledby="nav-profile-tab"
      >
        <div class="display-4 center my-3">mentor</div>
```

```
        <div class="row justify-content-center">
          <div class="col-md-4">
            <div class="card mt-0" style="width: 18rem">
              <div class="card-body">
                <img
                  class="card-img-top"
                  src="./assets/LN_M.jpg"
                  alt="Card image cap"
                />
                <h5 class="card-title my-3">Prof. Lakshman
Nandagiri</h5>
                <h6 class="card-subtitle mb-2 text-muted">
                  lnand@rocketmail.com
                </h6>
                <p class="card-text">
                  Professor HAG at National Institute of
Technology Karnataka
                  Surathkal
                </p>
                <a

href="https://www.linkedin.com/in/lakshman-nandagiri-14265317b/"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    class="linkedin"
                    height="512pt"
                    viewBox="0 0 512 512"
                    width="512pt"
                  >
                    <path
                      d="m256 0c-141.363281 0-256 114.636719-256
256s114.636719 256 256 256 256-114.636719
256-256-114.636719-256-256-256zm-74.390625
387h-62.347656v-187.574219h62.347656zm-31.171875-213.1875h-.40625c
-20.921875 0-34.453125-14.402344-34.453125-32.402344 0-18.40625
13.945313-32.410156 35.273437-32.410156 21.328126 0 34.453126
14.003906 34.859376 32.410156 0 18-13.53125 32.402344-35.273438
32.402344zm255.984375
213.1875h-62.339844v-100.347656c0-25.21875-9.027343-42.417969-31.5
85937-42.417969-17.222656 0-27.480469 11.601563-31.988282
```

```
22.800781-1.648437 4.007813-2.050781 9.609375-2.050781
15.214844v104.75h-62.34375s.816407-169.976562
0-187.574219h62.34375v26.558594c8.285157-12.78125
23.109375-30.960937 56.1875-30.960937 41.019531 0 71.777344
26.808593 71.777344 84.421874zm0 0"
                    />
                  </svg>
                </a>
                <a
                  href="mailto:lnand@rocketmail.com"
                  class="card-link"
                  target="_blank"
                >
                  <svg
                    version="1.1"
                    id="Capa_1"
                    xmlns="http://www.w3.org/2000/svg"
                    xmlns:xlink="http://www.w3.org/1999/xlink"
                    x="0px"
                    y="0px"
                    viewBox="0 0 512 512"
                    style="enable-background: new 0 0 512 512"
                    xml:space="preserve"
                  >
                    <g>
                      <path

d="M257,210c-24.814,0-45,20.186-45,45c0,24.814,20.186,45,45,45c24.
814,0,45-20.186,45-45C302,230.186,281.814,210,257,210z"
                        />
                    </g>
                    <g>
                      <path

d="M255,0C114.39,0,0,114.39,0,255s114.39,257,255,257s257-116.39,25
7-257S395.61,0,255,0z M362,330

c-20.273,0-38.152-10.161-49.017-25.596C299.23,319.971,279.354,330,
257,330c-41.353,0-75-33.647-75-75c0-41.353,33.647-75,75-75

c16.948,0,32.426,5.865,45,15.383V195c0-8.291,6.709-15,15-15c8.291,
0,15,6.709,15,15c0,33.36,0,41.625,0,75
```

```
c0,16.538,13.462,30,30,30c16.538,0,30-13.462,30-30c0-100.391-66.43
2-150-135-150c-74.443,0-135,60.557-135,135

s60.557,135,135,135c30,0,58.374-9.609,82.061-27.803c15.822-12.078,
33.94,11.765,18.281,23.789

C328.353,408.237,293.665,420,257,420c-90.981,0-165-74.019-165-165S
166.019,90,257,90c82.897,0,165,61.135,165,180
                C422,303.091,395.091,330,362,330z"
                     />
                   </g>
                  </svg>
                 </a>
               </div>
             </div>
           </div>
         </div>

         <div
           class="tab-pane fade"
           id="result"
           role="tabpanel"
           aria-labelledby="nav-profile-tab"
         >
           <table class="table table-striped my-3
justify-content-center">
             <tr>
               <th>Rainfall</th>
               <th>Runoff</th>
             </tr>
           </table>
         </div>
       </div>

       <footer class="container">
         <div class="center-footer">
           <p>&copy; NITK 2020</p>
         </div>
       </footer>
       <!-- jQuery and JS bundle w/ Popper.js -->
```

```
    <script
      src="https://code.jquery.com/jquery-3.5.1.slim.min.js"

integrity="sha384-DfXdz2htPH0lsSSs5nCTpuj/zy4C+OGpamoFVy38MVBnE+Ib
bVYUew+OrCXaRkfj"
      crossorigin="anonymous"
    ></script>
    <script

src="https://cdn.jsdelivr.net/npm/bootstrap@4.5.3/dist/js/bootstra
p.bundle.min.js"

integrity="sha384-ho+j7jyWK8fNQe+A12Hb8AhRq26LrZ/JpcUGGOn+Y7RsweNr
tN/tE3MoK7ZeZDyx"
      crossorigin="anonymous"
    ></script>
    <script src="./js/app.js"></script>
  </body>
</html>
```

ANNEXURE-II

```
$(document).ready(function() {
    var max_rain      = 100; //maximum input boxes allowed
    var wrapper         = $(".input_rain_wrap"); //Fields wrapper
    var add_button      = $(".add_rain_button"); //Add button ID

    var x = 1; //initial text box count


   $(add_button).click(function(e){ //on add input button click
        e.preventDefault();
        if(x < max_rain){ //max input box allowed

                //textbox increment
            $(wrapper).append('<div><input class="form-control
rain-data mb-3" placeholder="day-'+ (x+1) +'" type="number"
name="rain[]"><a href="#" class="remove_field"><svg class="rain"
version="1.1" id="Layer_1" xmlns="http://www.w3.org/2000/svg"
xmlns:xlink="http://www.w3.org/1999/xlink" x="0px" y="0px"
viewBox="0 0 512 512" style="enable-background:new 0 0 512 512;"
xml:space="preserve"><g><path
d="M275.676,256l111.169-111.169c5.435-5.433,5.435-14.242,0.001-19.
675c-5.435-5.433-14.243-5.433-19.677,0L256.001,236.325L144.832,125
.156c-5.433-5.433-14.243-5.433-19.678,0c-5.435,5.433-5.433,14.243,
0,19.677l111.169,111.169L125.154,367.169c-5.433,5.433-5.433,14.243
,0,19.677c2.717,2.717,6.278,4.075,9.838,4.075c3.561,0,7.122-1.358,
9.838-4.075l111.169-111.169l111.169,111.169c2.716,2.717,6.278,4.07
5,9.838,4.075s7.122-1.358,9.838-4.075c5.433-5.433,5.433-14.243,0-1
9.677L275.676,256z"/></g><g><path
d="M255.999,0.001C114.841,0.001,0,114.841,0,256s114.841,255.999,25
5.999,255.999S512,397.159,512,256S397.158,0.001,255.999,0.001z
M255.999,484.173C130.185,484.173,27.827,381.816,27.827,256c0-125.8
15,102.357-228.172,228.172-228.172S484.173,130.186,484.173,256C484
.173,381.816,381.815,484.173,255.999,484.173z"/></g></svg></a></di
v>'); //add input box
            x++;
        }
    });

    $(wrapper).on("click",".remove_field", function(e){ //user
```

```
click on remove text

            e.preventDefault();
            $(this).parent('div').remove();
            x--;
    })
});


$(document).ready(function() {
    var max_cn          = 100; //maximum input boxes allowed
    var wrapper         = $(".input_cn_wrap"); //Fields wrapper
    var add_button      = $(".add_cn_button"); //Add button ID

    var x = 1; //initial text box count


   $(add_button).click(function(e){ //on add input button click
        e.preventDefault();
        if(x < max_cn){ //max input box allowed

                //textbox increment
            $(wrapper).append('<div class="row"><div
class="col-6"><input class="form-control cn-p mb-3" placeholder="%
- '+ (x+1) +'"type="number" name="contribution[]"></div><div
class="col-6"><input class="form-control cn-v mb-3"
placeholder="CN-'+ (x+1) +'" type="number" name="cn[]"></div><a
href="#" class="remove_field"><svg class="cn" version="1.1"
id="Layer_1" xmlns="http://www.w3.org/2000/svg"
xmlns:xlink="http://www.w3.org/1999/xlink" x="0px" y="0px"
viewBox="0 0 512 512" style="enable-background:new 0 0 512 512;"
xml:space="preserve"><g><path
d="M275.676,256l111.169-111.169c5.435-5.433,5.435-14.242,0.001-19.
675c-5.435-5.433-14.243-5.433-19.677,0L256.001,236.325L144.832,125
.156c-5.433-5.433-14.243-5.433-19.678,0c-5.435,5.433-5.433,14.243,
0,19.677l111.169,111.169L125.154,367.169c-5.433,5.433-5.433,14.243
,0,19.677c2.717,2.717,6.278,4.075,9.838,4.075c3.561,0,7.122-1.358,
9.838-4.075l111.169-111.169l111.169,111.169c2.716,2.717,6.278,4.07
5,9.838,4.075s7.122-1.358,9.838-4.075c5.433-5.433,5.433-14.243,0-1
9.677L275.676,256z"/></g><g><path
d="M255.999,0.001C114.841,0.001,0,114.841,0,256s114.841,255.999,25
5.999,255.999S512,397.159,512,256S397.158,0.001,255.999,0.001z
```

```
M255.999,484.173C130.185,484.173,27.827,381.816,27.827,256c0-125.8
15,102.357-228.172,228.172-228.172S484.173,130.186,484.173,256C484
.173,381.816,381.815,484.173,255.999,484.173z"/></g></svg></a></di
v>'); //add input box
            x++;
        }
    });

    $(wrapper).on("click",".remove_field", function(e){ //user
click on remove text

        e.preventDefault();
        $(this).parent('div').remove();
        x--;
    })
});

$(".noob li.nav-item a.nav-link").click(function() {
  $(".noob li.nav-item a.nav-link").removeClass('active');
});

// document.querySelectorAll('.rain-data');
// document.querySelectorAll('.cn-p');
// document.querySelectorAll('.cn-v');

$('.calculate').on('click', (e) => {
    e.preventDefault();
    // document.querySelectorAll('.rain-data');
    // document.querySelectorAll('.cn-p');
    // document.querySelectorAll('.cn-v');

    // calculate Curve number
    var avgCN = 0, a = 0, b = 0, c = 0;
    for (let i =0; i < document.querySelectorAll('.cn-p').length;
i++) {
        a += parseInt(document.querySelectorAll('.cn-p')[i].value,
10);
        b = parseInt(document.querySelectorAll('.cn-p')[i].value,
10);
        c =
parseFloat(document.querySelectorAll('.cn-v')[i].value, 10);
        avgCN += b * c;
```

```
        //
console.log(document.querySelectorAll('.cn-p')[i].value);
    }
    avgCN =parseFloat((avgCN / a),10).toFixed(2);
    // console.log(`a = ${a}`);
    // console.log(`avgCN = ${avgCN}`);

    const AMC = document.querySelector('.AMC').value;
    const lambda =
parseFloat(document.querySelector('.lambda').value, 10);
    const CNType = document.querySelector('.CNType').value;
    const area_unit = document.querySelector('.area-unit').value;
    const area_data =
parseFloat((document.querySelector('.area-data').value), 10);
    var CN1, CN2, CN3;
    var retain = 0;
    var runoff = new Array();
    var rainfall = new Array();
    var total_runoff = 0;
    var runoff_volume = 0;
    if (AMC == 1) {
        if (CNType == 1) {
            CN1 = avgCN;
        } else {
            CN1 = (avgCN / (2.281 - (0.01281 *
avgCN))).toFixed(2);
        }
        retain = parseFloat((254 * ((100/CN1) - 1)),
10).toFixed(2);
    } else if (AMC == 2) {
        CN2 = avgCN;
        retain = parseFloat((254 * ((100/CN2) - 1)),
10).toFixed(2);
        // retain = 254 * ((100/CN2) - 1);
        // console.log(`CN2: ${CN2}`);
    } else if(AMC == 3) {
        if (CNType == 3) {
            CN3 = avgCN;
        } else {
            CN3 = (avgCN / (0.427 + (0.00573 *
avgCN))).toFixed(2);
            // retain = 254 * ((100/CN3) - 1);
```

```
        }
        retain = parseFloat((254 * ((100/CN3) - 1)),
10).toFixed(2);
    }
    console.log(retain);
    for (let i = 0; i <
document.querySelectorAll('.rain-data').length; i++) {
        let temp_rainfall =
parseFloat((document.querySelectorAll('.rain-data')[i].value),
10);
        rainfall.push(temp_rainfall);
        let temp_runoff = 0;
        if (temp_rainfall <= lambda * retain) {
            temp_runoff = 0;
        } else {
            temp_runoff = ((temp_rainfall - (lambda *
retain))**2)/(temp_rainfall + (1 - lambda) * retain);
        }
        runoff.push(temp_runoff);
        // console.log(temp_runoff);
    }
    // console.log(`a-d: ${area_data}`);
    // console.log(`a-u: ${area_unit}`);

    for (let i = 0; i < runoff.length; i++) {
        total_runoff = total_runoff + runoff[i];
    }
    console.log(`total_runoff: ${total_runoff}`);
    if (area_unit == 1) {
        runoff_volume = parseFloat((area_data * total_runoff *
10), 10).toFixed(2);
    } else {
        runoff_volume = parseFloat(((area_data * total_runoff) /
1000), 10).toFixed(2);
    }
    console.log(`runoff_volume: ${runoff_volume}`);

    for (let i = 0; i < runoff.length; i++) {

$("table").append(`<tr><td>${rainfall[i]}</td><td>${runoff[i].toFi
xed(2)}</td></tr>`);
    }
```

```
    $("#result").append(`<div class="display-4 center">Total
Runoff Depth: <strong>${total_runoff.toFixed(2)}(in
mm)</strong></div>`);
    $("#result").append(`<div class="display-4 center">Total
Runoff Volume: <strong>${runoff_volume}(in m^3)</strong></div>`);
    $("form").parent().removeClass('active');
    $("#result").addClass('active show');
    $("table").css('display', 'flex');
});
```