

MANUAL FOR PROJECT REPORT WRITING

for

UNDER GRADUATE DEGREE PROGRAMME
of
B. Tech. (Agricultural Engineering)



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MANUAL FOR THESIS/PROJECT REPORT WRITING

BASIC CHARACTERISTICS OF THESIS/PROJECT REPORT WRITING

A thesis/project report should be written with utmost accuracy and neatness of appearance. The writer should realize that good research cannot be better appreciated, if it is not presented properly and adequately. Due attention should be given to items such as titles, sub-titles, paragraphs, margins, spacing, tables, graphs, figures and the overall general appearance. The important considerations of good style for writing good thesis/project report include:

Clearness:

- i. It is essential that the reader should be able to grasp the subject matter quickly. To be clear, the language should be grammatically correct. Violations of grammar and punctuation lead to obscurity and ambiguity. Due attention should be paid to the importance of concise-clear statement with exact definition. Clarity can be achieved by the use of appropriate word (s) and relevant technical terms. Uncommon words should be defined in the interest of clearness.
- ii. Every sentence should be structured carefully, clearly indicating the thought. As far as possible short declarative sentences should be used. Excessive use of the compound sentences detracts from clearness.
- iii. Clearness should also be applied to paragraph structure. The sentences in the paragraph should proceed in a logical order, each clear in the light of what has preceded and pertinent to the topic of the paragraph.
- iv. Similar style of language should be followed throughout the write up. Titles/Headings sub-titles/sub-heads, paragraph side headings and illustrations, drawings or figures are of immense value in making writing clear. These should invariably be used wherever necessary.

Conciseness:

- i. Conciseness of language is gained by using words in their exact meaning, straight-forwardly, and by avoiding round about methods of expressing an idea.
- ii. Tabular presentations and graphics help to make the writing of thesis/project report not only attractive and self-explanatory, but also concise the matter.

Completeness:

- i. A thesis/project report should incorporate all the information which the reader should know in order to understand the topic.
- ii. The writer should observe proper proportion of all major components of the thesis/project report. One part or section should not be over emphasized to the detriment of the other. A complete treatment of the subject leaves the reader satisfied and in a mood to receive the writer's ideas.

Organization:

- i. The thesis/project report writing should have coherence, should develop from logical beginning to a logical conclusion.
- ii. Organization may be secured by using a plan based on chronological order following a process step by step.

Unity:

- i. Unity in writing is intimately linked with careful organization of the subject matter, dealing one subject at a time.
- ii. Unity in the sentence demands that one sentence develops one thought such that its unity is not destroyed by the addition of unrelated thoughts. All related thoughts should be treated in one paragraph. Every new thought should be of a separate paragraph, even though it is of a single sentence.
- iii. Double message should be avoided in the conclusions and recommendations. Each conclusion and recommendation should deal with a single unified idea.

Style:

- i. Style forms the essence of thesis/project report. It does not mean mere literary style.

- ii. The ideas/results can be better interpreted and quickly appreciated by use of appropriate illustrations/graphics supported by a brief description rather than a full length written discussion.
- iii. The thesis/project report is usually written in passive voice, past tense (mostly) and in third person. One should avoid personalized element ('I did', 'I went', 'as recorded by me or us' etc.) while describing the results, ideas etc.
- iv. A sentence not to be started with abbreviated form of word or group of words (wt. or ICAR to be spelt out) neither with numerical figure(2 kg- to be spelt out)
- v. Non English word(s) to be written in italics (*Bhata, Matasi, Paneer, Rabi, Kharif* etc.) . (Please refer text format for further style)

PARTS OF A THESIS/PROJECT REPORT

A thesis/project report submitted in partial fulfillment of the requirements for the undergraduate degree should consist of three main parts in order as listed below. It should be specifically noted that since a thesis/project report is submitted in partial fulfillment of the requirement of the degree and not as a personal asset of the student, the thesis/project report can not be dedicated to any one.

A. The first part will consist :

- The Cover
- Title Page
- CERTIFICATE - I
- CERTIFICATE - II
- ACKNOWLEDGEMENT
- CONTENTS
- LIST OF TABLES
- LIST OF FIGURES
- LIST OF SYMBOLS/NOTATIONS
- LIST OF ABBREVIATIONS
- ABSTRACT

B. The second part will consist:

- INTRODUCTION
- REVIEW OF LITERATURE
- MATERIALS AND METHODS

- RESULTS AND DISCUSSION
- SUMMARY AND CONCLUSION

C. The third part will consist :

- REFERENCES
- APPENDIX/APPENDICES

The first part

- The Cover page:** This should include the title of thesis/project report, name of the student (as enrolled in VV), name of the College, its location, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) and year of submission. The alignment/spacing etc. should be as in **Sample Sheet 'A'**.
- The Title Page:** This page is next to the cover page and it should include the title of thesis/project report, submitted to the Indira Gandhi Krishi Vishwavidyalaya, Raipur by (name of the student) in Partial Fulfillment of the requirements for the degree of B.Tech. (Agril. Engg.), month and year and Roll No. and ID No. of the student. The alignment/spacing etc. should be as in **Sample Sheet 'B'**.
- CERTIFICATE - I:** This should be in the format as given in **Sample Sheet 'C'**.
- CERTIFICATE - II:** This should be in the format as given in **Sample Sheet 'D'**.
- ACKNOWLEDGEMENT:** In this section the student should acknowledge by name the help and assistance received by him/her during the course of research and thesis/project report writing, from all the persons/institutions or organizations. 'Acknowledgement' should be in one page. It should not be emotionally extended to thank god and almighty, neither to sentimentally attached dozen of school college friend or neighbors. Through the page is privilege to the student, but the major advisor may have a watch on it.
- CONTENTS:** The contents of the thesis/project report should be given in tabular form listing all the components of the three parts. The type setting and alignment of 'Contents' should be as given in **Sample Sheet 'E'**.

- g) **LIST OF TABLES:** This is in tabular form including the No. and title of the tables (as in the text) along with the page No. on which they appear in thesis/project report. The type setting and alignment of 'List of Tables' should be as given in **Sample Sheet 'F'**.
- h) **LIST OF FIGURES:** This is in tabular form including the No. and title of the figures (as in the text) along with the page No. on which they appear in thesis/project report. All the graphs, line drawings, maps, photographs or other illustrations should be included as 'Figures' only. The type setting and alignment of 'List of Figures' should be as given in **Sample Sheet 'G'**.
- i) **LIST OF SYMBOLS/NOTATIONS:** The various symbols/notations used in the text should conform to standard format. All these should be included in the list in alphabetical order. The type setting and alignment of 'Contents' should be as given in **Sample Sheet 'H'**.
- j) **LIST OF ABBREVIATIONS:** The various abbreviations used in the text should conform to standard format. All these should be included in the list in alphabetical order. The type setting and alignment of 'Contents' should be as given in **Sample Sheet 'I'**.

In instances where there are a few notations or symbols, these can be combined and included in the List of Abbreviations or *vice versa*.

Each of the preliminaries should appear on a new page. The title (except in cover and title page) should be **right-aligned** on top of the page, except the certificates, where the title alignment should be at the top centre. If title of any table or figure, including the title on cover and title page, is in more than one line it should typed in single spacing. The Certificates are typed in one and half spacing and the Acknowledgement in single spacing. The title of the thesis/project report should normally be not more than two lines, type-set in '**inverted pyramid**' pattern. The title of the each preliminaries should be typed in all caps, Times New Roman, 14 point, bold font, and left aligned and after which a bold line is drawn.

ABSTRACT

Abstract is different from Summary. The abstract should be informative enough to give a clear idea of the thesis/project report content, when read independently. An abstract should be understood in the absence of the thesis/project report and hence, it is a micro-thesis/project report (Summary is read after the main chapters of the thesis/project report). Summary cannot go without the main text; whereas, an abstract can go without the thesis/project report or main text. The typical format of an Abstract is given in **Sample Sheet 'J'**. The abstract should be included in the thesis/project report at the end.

The second part

The main body of the thesis/project report is divided into different Chapters (I to V or VI) as outlined below

CHAPTER - I

INTRODUCTION

The introduction should indicate the importance and purpose of selecting the research topic, clearly mentioning the limitations or shortcomings in the existing knowledge thereto with important citations (not too many). It should clearly indicate the usefulness/application of outcome of the proposed research. The objectives of the study should be clearly spelt out in introduction. The first page of 'Introduction' is the first page of the thesis/project report.

CHAPTER - II

REVIEW OF LITERATURE

The pertinent literature projecting the research area/topic of the thesis/project report should be critically reviewed in this chapter. The research work carried out in India and abroad should be reviewed, mainly concentrating to the recent past, written in past tense in chronological order, under each heading, sub-heading or sub-sub-heading relating to different aspects of the review.

CHAPTER - III

MATERIALS AND METHODS

This chapter should start with brief outline of the programme of the study and describe the experimental design, materials used and the experimental methods/techniques employed, in accomplishing the objectives of the research topic of the experiment. The routine analytical work may preferably be listed with relevant reference in a table only. The chapter may include meteorological data during the period of study and necessarily the lay out of field experiment if applicable. The specifications of the various materials (supported by suitable illustrations/photos, wherever applicable) and their sources, experimental conditions, different equipment used, statistical analyses etc with pertinent references should be stated. This chapter is written in past tense. This chapter is dealt under different headings and sub-headings. The 'Materials and Methods' should provide all the information/details for repetition of the experiments. Theoretical consideration/ assumptions/ calculations/ principles/ mathematical models, if any may be relevantly outlined in this chapter only.

If within the text mathematical equations are required to be included then following patten of writing equations should be adopted using "equation editor"

$$SW_t - SW_0 = \sum_{t=1}^t (R_{day} - Q_{surf} - E_a - w_{seep} - Q_{gw}) \quad (3.1)$$

where, SW_t is the final soil water content (mm), SW_0 is the initial soil water content (mm), etc....

$$Q_{surf} = \frac{(R_{day} - I_a)^2}{(R_{day} - I_a + S)} \quad (3.2)$$

where, Q_{surf} is the accumulated runoff or rainfall excess (mm), R_{day} is the rainfall depth for the day (mm), etc..

CHAPTER – IV

RESULTS AND DISCUSSION

This chapter forms the core of the thesis/project report. The chapter should start with precise details of programme of study as introduction of the chapter. The results should be described (in past tense) through factual statements based on the actual observations made. The data should be adequately tabulated and interpreted on statistical inferences. The important data/results which need to be highlighted can be explained through suitable illustrations/graphs/figures. First, the results obtained should be discussed considering the variables/treatments employed. Then the results should be compared with the observations of past workers. The discussion part should also include scientific support/valid explanation for the observed results. This chapter also consists of different headings and sub-headings. Either interpretation of results may immediately /simultaneously be followed up with relevant discussion for every parameter or results relevant to all parameters may be presented sequentially followed by a comprehensive discussion for all the parameter under study. The tables with the relevant data may be adjusted within the text of the result of the parameter and the tables continuing to the next page may be avoided.

Each table must be within the thesis/project report page size (A-4) and preferably it should be presented in portrait form. Each table should be contained with a proper title and data column with SI units. Number or column in a table to be restricted so as to ease volume of

data. First column, usually the treatment or parameter of study must be well detailed so as to make the table self explanatory: if needed, such details may be given in footnote of the table. If such column is repeated in number of tables, the relevant details must also be repeated in footnote of all such tables. The decimals in columns must be in proportion of the integer value of the data (e.g., 0.123, 5.12, 50.14 etc.). Data are normally subjected to statistical analysis with depiction of CD values/ $SE_m \pm$ in the table for effective and meaningful interpretation of results.

Figures to have captions below the figures and numbered. Figures must contain with the legends and preferably the relevant values of CD, r^2 etc. Citation of references must be uniformly followed. For example:

Singh, (1963).....
..... (Singh, 1963)
Singh and Sharma (1963)
.....(Singh & Sharma, 1963)
Singh *et al.* (1963)
.....(Singh *et al.*1963)

In case of more then one reference in parentheses, the ascending year should form the follow up order.

(Singh, 1963; Singh & Sharma, 1973 & Singh *et al.* 1983)

This above mentioned format of presentation for references should also apply in case of review of literature.

In running text citing table, figure should be in lower caps, but when cited in parentheses these may start with capital letter like Table, Fig..

CHAPTER – VI

SUMMARY AND CONCLUSION

The 'Summary' should condense the thesis/project report in its entirety. While summarizing the thesis/project report, it should be kept in mind that a summary is always at the end of main chapters of the thesis/project report; hence, it should not be a repetition of statements already mentioned in earlier Chapters. Conclusion should be drawn based on the results obtained considering the purpose of the study and objectives mentioned in the introduction. The result of an experiment cannot be a conclusion. The conclusion should be a comprehensive statement/statements based on results of all the experimental investigations conducted. The conclusion is written under the heading **CONCLUSION** (bold, 12 point, Times New Roman font, left aligned). Suggestions, if any, for future work and/or for further continuation of the research on the topic or the field applicability of the outcome of the research should be stated after the conclusion, under the heading **SUGGESTIONS FOR FUTURE RESEARCH WORK** (bold, 12 point, new Roman times font, left aligned).

Text Format

Text format pertaining to all the chapters referred as above should be presented in the following form.

A Thesis/project report should be typed on A4 size white bond paper of uniform color and texture or thickness with the margins: At least Top 1.2", Bottom 1.2", Right 1.2" and Left 1.5". Copies of the thesis/project report should be mistake-free and preferably without corrections or inserts in ink. The first sentence of any paragraph should start after leaving the blank space of $\frac{1}{2}$ " (using tab setting). The line spacing should be one and half, except in titles, headings or sub-headings, lists of tables or figures, symbols/notations and abbreviations and in references, where the line spacing should be one. However, in references the spacing in between two consecutive references should be one and half. The first page of a Chapter should have 1.5" top margin.

Every page of the thesis/project report, except the cover and title pages, should be numbered. All the preliminary pages should be numbered in small Roman numeral at bottom centre of the page. The main text and the end pages should be typed in consecutive Indian (Arabic) numerals in top margin right aligned, starting at 1 from the first page of Introduction and ending on last page (Vita). The number on the starting page of the chapters or end sections should be at centre of bottom margin.

Every chapter should begin on a new page. The chapter No. to be typed on the first line in all caps, Times New Roman, 14 point, bold font. The title of the chapter should be typed in all caps Times New Roman 16 point bold font, below the chapter No. in single space, after which a bold line is drawn. Both the chapter No. and title should be right aligned. The different aspects or sections in Review of Literature, Materials and Methods, Results and Discussion should be written following a fixed chronological numbering system as illustrated in the Table of contents (**Sample Sheet 'E'**).

The serial numbering of Tables and Figures should be as per their appearance in respective Chapters (as listed in **Sample Sheets 'F' and 'G'**). The tables and figures should have technical prominence and clarity, instead of mere artistic expression. The format (type setting and alignment) of Tables and Figures should be as per the respective formats as given **Sample Sheets 'K' and 'L'**. A table should appear immediately next to its citation in the text (on the same page or on next page). If the text, on a single page refers to more than one table, the tables should be included serially, after that text page. Similarly a figure should appear immediately next to its citation in the text (on the same page or on next page). If the text, on a single page refers to more than one figure, the figures should be included serially, after that text page. When a table is referred in the running text it should "the data as shown in Table 4.2 reveal that" (here t of table should be in Capital). Likewise when a group is referred it should be 'Group II or Group III or Groups II to V and so on. In case of figures, it should be Fig. 3. 2 (in Materials and Methods) or 4.3 (in Results and Discussion) and so on. When more than one table or figure is cited in the text it should be Tables 4.2 and 4.6 or Tables 4.2 to 4.6 and Fig. 3.1 and 3.2 or Fig. 4.3 to 4.7, respectively.

The abbreviations, short forms, notations or symbols should be in internationally accepted format. The abbreviations/short forms should not be interposed with full stops (example: Not W.H.O. or I.C.A.R.; it should be WHO or ICAR). In case of any word having more than one internationally accepted form, only one type should be used in all chapters/sections of the thesis/project report (example: Gram is represented by g, gm, Gm or G).

a) If the report/research work is of one or two authors:

Adam (1974) reported high mortality in mice fed 40 to 50 % of *J. curcas* seed in their feed. The important symptoms of poisoning recorded by them were depression.

Adam and Magzoub (1975) carried out short term toxicity studies of *J. curcas* seeds in Nubian goats and reported varying degrees of degenerative changes in their liver

b) If the report/research work is of more than two authors:

Stirpe *et al.* (1976) conducted a comparative oral dosing toxicity study of curcin and crotin (*Croton tiglium*) in mice. They found that curcin, as compared to crotin had slightly more rapid action with the onset of symptoms within *et al* is the abbreviation of Latin words *et alii* or *alia* meaning and other people. The abbreviation should be written as *et al.*, but not *et. al.*, and it should be italicized (*et al.*). In fact, all the words alien to English should be italicized (all botanical/zoological names and other words like *in vitro*, *in vivo*, *ex vivo*, *ad libitum* etc.). The pattern of such references in Review of Literature should be a typical format. It should be Ahmed *et al.* (1979 a) reported In Results and Discussion such citations can appear in parentheses. For example " The results of the acute toxicity in rat as observed in the present study are contrary to the earlier observations in dog (Ranade *et al.*, 1978) and calves (Vivek *et al.*, 1979; Singh *et al.*, 1982; Bell *et al.*, 1985). The initials of authors should not be written in text wherever the citations are referred.

c) If more than one report/research work of the same author/authors appeared in the same year:

Ahmed and Adam (1979 a) evaluated toxicity of *J. curcas* in calves orally administered the water (stomach tube) in which *Jatropha* seeds were suspended at

Ahmed and Adam (1979 b) reported toxicity of *J. curcas* in desert sheep and Nubian goats fed on its seeds at 0.05, 0.5 and 1gm/kg/day. They recorded diarrhoea,

d) If the report/research work is of same author or authors appeared in different years:

The citations should be in the chronological order under separate paragraphs.

The third part

REFERENCES

The reference of each research work/report cited in the text should be given in full as illustrated below:

Journal reference:

- Bharadwaj, S.P and Sindhwal, N.S. (1998). Zero tillage and weed mulch for erosion control on sloping farm land in Doon valley. *Indian Journal of Soil Conservation* **26**: 81-85.
- Roy, P.S., Rangnath, B.K., Diwakar, P.G., Vohara, T.P.S., Bhan, S.K., Singh, S.J. and Pandian, V.C. (1991). Tropics forest type mapping and monitoring using remote sensing. *International Journal of Remote Sensing*, **12**: 2205-2225.

References of authors in the same year:

- Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Williams, J.R. 1998 a. Large area hydrologic modeling and assessment, part I: Model development, *Journal of American Water Resources Association*, **34**: 73-89.
- Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Allen, P.M. 1998 b. Continental scale simulation of hydrologic balance. *Journal of American Water Resources Association*, **35**: 1037-1050.

Anonymous Reference:

- Anonymous. 1994. Drip Irrigation in India. INCID, Ministry of Water Resources, Govt. of India, New Delhi. July, p.1 [In text to be cited as Anon. (1994) or (Anon., 1994)]
- Anonymous. 1994. Social changes in Doon Valley by Lab-to-Land programme. *Indian Farming*, **43**: 13-18.

Note: References of same authors in different years should be given in chronological order.

Book References:

- Mannering, J.V. 1981. The use of soil tolerances as strategy for soil conservation. Soil conservation problem and prospects. R.P.C. Morgan John Wiely & Sons, Chichester, England, pp. 337-349.
- Michael, A.M. 1978. Irrigation: Theory and Practice. 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, pp. 585-594.

Proceedings/Symposia/Seminars/Conferences:

- DiLuzio, M., Srinivasan, R. and Arnold, J.G. 2001. Application of AVSWAT for a TMDL case in central Texas. Proceedings of International SWAT Conference, *In: SFB 299 and Justus-Liebig-University Giessen, Germany*, pp. 12-13.
- Pal, A.R., Rathore, A.L. and Pandey, V.K. 1994. On farm rain water storage systems for improving rice land productivity in Eastern India : Opportunity and Challanges. *In: Bhuiyan, S.I. (Ed), on Farm Reservoir System for Rained Rice Lands. Proceedings of International Conference, International Rice Research Institute, Manila, Philippines Publication*, pp. 105-125.

Thesis:

- Devikar, P. 2006. Study of hydro-meteorological droughts in Tel basin of Mahanadi River System. M. Tech. thesis, Indira Gandhi Krishi Vishwavidyala, Raipur, pp. 41-44.
- Patel, A.K. 2006. Studies on toxicity of *Jatropha curcas* (*Ratanjyot*) seeds in calves. Thesis/project report, Indira Gandhi Krishi Vishwavidyala, Raipur, p. 87.

Reports:

- Anonymous.1998. Annual Report, National Institute of Occupational Health, Ahmedabad, p.14.

Standards:

- IS:5701 (Part VIII). 1979. Indian Standard. Code for breeding, care, management and housing of laboratory animals. Part VIII.

Laboratory chicks. Indian Standards Institution, New Delhi, pp. 1-15.

Acts:

The Prevention of Cruelty to Animals Act. 1960. 59 of 1960. as amended by Central Act 26 of 1982. Animal Welfare Board of India, Chennai, pp. 1-23.

Internet Reference:

<http://www.novoboard.com/Jatropha.doc>. (2006) *Jatropha (Ratanjyot)*

Note : The references should be typed in single space, hanging format with 1.5 spacing in between two consecutive references. The page numbering of References should be in continuation from the last page of Summary and Conclusion. The internet references should appear as last reference in the list. (Sample Sheet 'M')

APPENDIX/APPENDICES

This section may include all the supporting data of statistical analyses of various results/experiments/observations, meteorological data, composition of the media, specifications of equipment (if required), details of survey questionnaires/ particulars and computer programme if developed etc.. If there are more than one Appendix, the Appendices are numbered serially as Appendix - A, Appendix - B, Appendix - C and so on. The page numbering of Appendices should be in continuation from the last page of References. The APPENDIX - and its title should be typed in all caps Times New Roman 14 point bold font, right aligned and a bold line is drawn below.

SAMPLE SHEET "A"

**WATERSHED PARAMETERIZATION
USING GEOGRAPHIC INFORMATION
SYSTEM AND SATELLITE REMOTE
SENSING**

(Times New Roman, font size 16 pt., all capital, bold in inverted pyramid form, not more than three lines in single spacing and centre aligned)

Thesis/Project Report

(Times New Roman, font size 14 pt., bold, centre aligned)

**Bachelor of Technology
in
Agricultural Engineering**

by

(Times New Roman, font size 14 pt., bold, centre aligned)

Anil Kumar Singh

.....
.....
.....

(Times New Roman, font size 14 pt., bold, centre aligned)



**BRSM College of Agricultural Engineering and Technology,
Mungeli
Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG)**

2013

(Times New Roman, font size 15 pt., bold, centre aligned)

SAMPLE SHEET "B"

**WATERSHED PARAMETERIZATION USING GEOGRAPHIC
INFORMATION SYSTEM AND SATELLITE REMOTE
SENSING**

(Times New Roman, all capital, font size 16 pt., bold in inverted
pyramid form, not exceeding more than three lines in single spacing
and centre aligned)

Thesis/Project Report

(Times New Roman, font size 14 pt., bold, centre aligned)

Submitted to the

(Times New Roman, font size 14 pt., bold, centre aligned)

**BRSM College of Agricultural Engineering and Technology,
Mungeli**

Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG)

(Times New Roman, font size 14 pt., bold, centre aligned)

by

(Times New Roman, font size 14 pt., bold, centre aligned)

Anil Kumar Singh, I.D. No.:

.....
.....
.....

(Times New Roman, font size 14 pt., bold, centre aligned)



**IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF**

(Times New Roman, font size 14 pt., bold, centre aligned)

BACHELOR OF TECHNOLOGY

(Times New Roman, font size 14 pt., bold, centre aligned)

IN

(Times New Roman, font size 14 pt., bold, centre aligned)

AGRICULTURAL ENGINEERING

(Times New Roman, font size 14 pt., bold, centre aligned)

DECEMBER, 2013

(Times New Roman, font size 14 pt., bold, centre aligned)

SAMPLE SHEET "C"

CERTIFICATE - I

(Times New Roman, all capital, font size 14 pt., bold, centre aligned)

This is to certify that the thesis/project report entitled **"Watershed parameterization using geographic information system and satellite remote sensing"** submitted in partial fulfilment of the requirements for the degree of **Bachelor of Technology (Agricultural Engineering)** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by Mr./Ms. **Anil Kumar Singh** under my guidance and supervision. The subject of the thesis/project report has been approved by the Student's Advisory Committee and the Dean.

No part of the thesis/project report has been submitted for any other degree or diploma. *No part of the thesis/project report has been published/ a part of the thesis/project report has been published and the same has been acknowledged.

(Times New Roman, font size 12 pt., normal/bold as indicated, justified)

Date:

Major Advisor

Name & Signature

* Omit whichever is not applicable.

SAMPLE SHEET "D"

CERTIFICATE - II

(Times New Roman, all capital, font size 14 pt., bold, centre aligned)

This is to certify that the thesis/project report entitled "**Watershed parameterization using geographic information system and satellite remote sensing**" submitted by **Anil Kumar Singh** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfilment of the requirements for the degree of **Bachelor of Technology (Agricultural Engineering)** has been approved by the Examination Committee after oral examination.

Date:
External Examiner

Name and signature of the

Major Advisor

Dean

(Times New Roman, font size 12 in normal/bold as indicated, justified)

SAMPLE SHEET "E"

CONTENTS

(Times new Roman, 16 pt., Bold, centre align)

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SAMPLE SHEET " H "
LIST OF NOTATIONS/SYMBOLS
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<i>A_{ch}</i>	Cross-sectional area of flow in the channel (m ²)
<i>A_{ch,bnkfull}</i>	Cross-sectional area of flow in the channel when filled to the
<i>Area</i>	Sub basin area (km ² or ha)
<i>AWC</i>	Available water capacity (mm)
<i>C</i>	Runoff coefficient
<i>C_{CH}</i>	Channel cover factor
<i>C_{USLE}</i>	USLE cover and management factor
<i>C_{USLE,mm}</i>	Minimum value for the cover and management factor for the land cover
<i>CFRG</i>	Coarse fragment factor
<i>CN</i>	Curve number
<i>DA</i>	HRU drainage area (km ²)
<i>E_a</i>	Actual amount of evapotranspiration (mm)
<i>E_{ch}</i>	Evaporation from the reach (m ³)
<i>E_o</i>	Potential evapotranspiration (mm d ⁻¹)
<i>E</i>	Maximum soil water evaporation (mm)
<i>E_t</i>	Transpiration rate (mm d ⁻¹)
<i>E_{N sed}</i>	N enrichment rate
<i>E_{P sed}</i>	P enrichment rate
<i>E_{NS}</i>	Nash-Sutcliffe simulation efficiency
<i>FC</i>	Water content of soil profile at field capacity (mm)
<i>FC_{ly}</i>	Water content of layer <i>ly</i> at field capacity (mm)
<i>G</i>	Heat flux density to the ground (MJ m ⁻² d ⁻¹)
<i>H_{day}</i>	Solar radiation reaching ground (MJ m ⁻² d ⁻¹)
<i>H_{MX}</i>	Maximum possible solar radiation (MJ m ⁻² d ⁻¹)
<i>H_{net}</i>	Net radiation on day (MJ m ⁻² d ⁻¹)

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SAMPLE SHEET " I "
LIST OF ABBREVIATIONS
(Times New Roman, 16 pt., Bold, right align)

A, B, C & D	Hydrological soil groups
AGNPS	Agricultural Nonpoint Source
AMC	Antecedent Moisture Condition
ANSWERS	Areal Nonpoint Source Watershed Environment Response Simulation
ARS	Agricultural Research Services
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
AWARA	American Water Resources Association
BMP	Best Management Practice
CCT	Computer Compatible Tape
CN	Curve Number
CREAMS	Chemical Runoff and Erosion from Agricultural Management System
CP	Conventional tillage
CT	Conservation tillage
DEM	Digital Elevation Model
DHI	Danish Hydraulic Institute
DOP	Date of pass
DP	Disc plough
DPI	Dot per inch
DVC	Damodar Valley Corporation
EASI	Environmental Analysis and Scientific Interface
EPA	Environmental Protection Agency
EPIC	Erosion Productivity Impact Calculator

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SAMPLE SHEET "J"

ABSTRACT

**WATERSHED PARAMETERIZATION USING GEOGRAPHIC
INFORMATION SYSTEM AND SATELLITE REMOTE
SENSING**

ABSTRACT

The present study was aimed at investigating hydro-meteorological aspects of droughts in Tel basin, which is a part of Mahanadi river system located in the western parts of Orissa. The primary goal of the study was to investigate the past drought events and dry spells in the Tel basin and to workout the supplemental irrigation water requirement to protect kharif crops from prolonged dry spells and drought. The study includes probability distribution of annual and seasonal rainfall, monthly/seasonal/annual rainfall departure, determination of critical dry spell (CDS), estimation of supplemental irrigation water requirement for CDS, estimation of standardized precipitation index (SPI) to inspect the pattern of rainfall anomalies and estimation of streamflow drought duration & severity. Analysis of rainfall records for 12 stations revealed that the drought occur in different parts of the basin with an average frequency of 5-6 years. The SPI analysis on multiple time scale reveal that selection of time scale for SPI estimation plays significant role in analyzing the past meteorological drought events in a given place/region.

Date:.....

(Name and Signature of the student)

(Signature of the Major adviser)

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SAMPLE SHEET "K"

Table 3.2: Statistical analyses of the observed and simulated nutrient losses

Statistical parameters	NO ₃ -N		Organic N		Soluble P		Organic P	
	Obs	Simu	Obs	Simu	Obs	Simu	Obs	Simu
Mean (kg/ha)	0.016	0.019	0.017	0.019	0.014	0.013	0.001	0.001
Std. Dev. (kg/ha)	0.014	0.016	0.015	0.023	0.014	0.013	0.002	0.003
Maximum (kg/ha)	0.041	0.050	0.050	0.070	0.037	0.040	0.006	0.010
Sum (kg/ha)	0.179	0.210	0.188	0.210	0.159	0.140	0.012	0.010
Count	11	11	11	11	11	11	11	11
t-calculated	-0.440		-0.240		0.300		0.160	
t-critical	2.090		2.090		2.090		2.090	
r ²	0.830		0.820		0.810		0.910	
RMSE (kg/ha)	0.007		0.011		0.006		0.001	
D _v %	-17.060		-11.700		12.120		16.390	

Obs = Observed, Simu = Simulated

Note: This is the Second Table of Chapter - III (Materials and Methods)

Table 4.4: Parameters used for model calibration

Sl. No.	Calibrated parameters	Values chosen	Prescribed range
1	Mannings 'n' for overland flow	0.068	0.01 - 0.12
2	Mannings 'n' for the main channels	0.19	0.01 - 0.30
3	Mannings 'n' for the tributary channels	0.21	0.01 - 30.00
4	Effective hydraulic conductivity in the main channel alluvium (mm/hr)	1.00	0.01 - 150.00
5	Effective hydraulic conductivity in the tributary channel alluvium (mm/hr)	6.75	0.01 - 150.00
6	Alpha factor for ground water	0.80	0.00 - 1.00
7	Specific yield (m/m)	0.003	0.00 - 0.40
8	Channel erodibility factor	0.50	0.05 - 1.00

Note: This is the Fourth Table of Chapter - IV (Results and Discussion)

(Note: Keep only upper and lower lines of the tables visible. Do not keep all the boxes of the table visible. This gives good look of the text and also saves the printing ink)

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Note: This is the Fourth Figure of Chapter V (Results and Discussion)

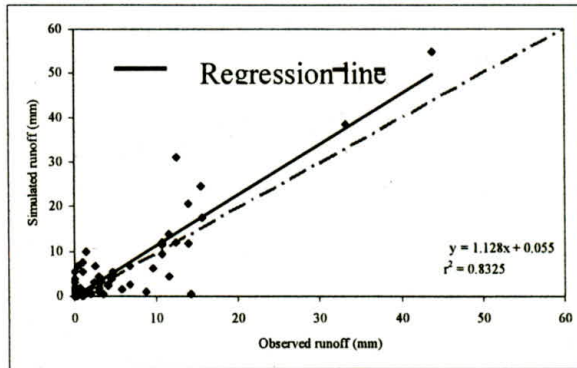


Fig. 4.5 : Comparison between observed and simulated daily runoff

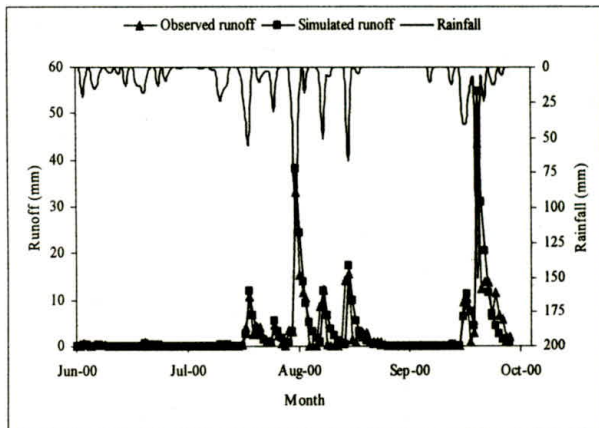


Fig. 4.4 : Observed and simulated runoff hydrograph

Note: If the size of the graphs is small then two graphs can be placed in a parallel manner as shown above to ensure the page economy, provided the presentation of the graphs and text on the graph is clear and readable.

SAMPLE SHEET "M"

REFERENCES

(Times New Roman, 16 pt., Bold, right align)

- Anonymous. (1998). Annual Report, National Institute of Occupational Health, Ahmedabad, pp.14.
- Anonymous. (1994). Drip Irrigation in India. INCID, Ministry of Water Resources, Govt. of India, New Delhi. July, pp.1.
- Anonymous. (1994). Social changes in Doon Valley by Lab-to-Land programme. *Indian Farming*, **43**: 13-18.
- Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Williams, J.R. (1998 a). Large area hydrologic modeling and assessment, part I: Model development, *Journal of American Water Resources Association*, **34**: 73-89.
- Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Allen, P.M. (1998 b). Continental scale simulation of hydrologic balance. *Journal of American Water Resources Association*, **35**: 1037-1050.
- Bharadwaj, S.P and Sindhwal, N.S. (1998). Zero tillage and weed mulch for erosion control on sloping farm land in Doon valley. *Indian Journal of Soil Conservation* **26**: 81-85.
- Chopra, R.N., Nayar, S.L. and Chopra, I.C. (1956). Glossary of Indian Medicinal plants. 1st Edition, I, Council of Scientific and Industrial Research, New Delhi, pp. 145
- Devikar, P. (2006). Study of hydro-meteorological droughts in Tel basin of Mahanadi River System. M. Tech. thesis/project report, Indira Gandhi Krishi Vishwavidyala, Raipur, pp. 41-44.
- DiLuzio, M., Srinivasan, R. and Arnold, J.G. (2001). Application of AVSWAT for a TMDL case in central Texas. Proceedings of International SWAT Conference, *In*: SFB 299 and Justus-Liebig-University Giessen, Germany, pp. 12-13.
- Finco, D.R. (1997). Kidney function. *In*: Kaneko, J.J., Harvey, J.W. and Bruss, M.L. (Eds) *Clinical Biochemistry of Domestic Animals*, 5th Edition, Harcourt Brace and Company Asia PTE Ltd., Singapore, pp. 441- 484.
- Gburek, W. J., Sharpley, A.N., Heathwaite, L., and Folmar, G.J. (2000). Phosphorus management at watershed scale: A

- modification on Phosphorous index. *Journal of Environmental Quality*, 29:130-144.
- Kirtikar, K. R. and Basu, B. D. (1975). Indian Medicinal Plants. Vol.III, Bishon Singh and Mahendra Singh, Delhi, pp. 2240-2247.
- Mannering, J.V. (1981). The use of soil tolerances as strategy for soil conservation. Soil conservation problem and prospects. R.P.C. Morgan John Wiely & Sons, Chichester, England, pp. 337-349.
- Michael, A.M. (1978). Irrigation: Theory and Practice. 4th Edition, Vikas Publishing House Pvt. Ltd., New Delhi, pp. 585-594.
- Pal, A.R., Rathore, A.L. and Pandey, V.K. (1994). On farm rain water storage systems for improving rice land productivity in Eastern India : Opportunity and Challenges. In: Bhuiyan, S.I. (Ed), on Farm Reservoir System for Rained Rice Lands. Proceedings of International Conference, International Rice Research Institute, Manila, Philippines Publication, pp. 105-125.
- Patel, A.K. (2006). Studies on toxicity of *Jatropha curcas* (*Ratanjyot*) seeds in calves. Thesis, Indira Gandhi Krishi Vishwavidyala, Raipur, pp. 87.
- Roy, P.S., Rangnath, B.K., Diwakar, P.G., Vohara, T.P.S., Bhan, S.K., Singh, S.J. and Pandian, V.C. (1991). Tropics forest type mapping and monitoring using remote sensing. *International Journal of Remote Sensing*, 12: 2205-2225.
- IS:5701 (Part VIII). (1979). Indian Standard. Code for breeding, care, management and housing of laboratory animals. Part VIII. Laboratory chicks. Indian Standards Institution, New Delhi, pp. 1-15.
- The Prevention of Cruelty to Animals Act. (1960). 59 of 1960. as amended by Central Act 26 of 1982. Animal Welfare Board of India, Chennai, pp. 1-23.
- <http://www.novoboard.com/Jatropha.doc>. (2006) *Jatropha* (*Ratanjyot*)

