

इंदिरा गांधी कृषि विश्वविद्यालय  
कृषक नगर, रायपुर 492012 (छत्तीसगढ़)

क्रमांक / शैल-1 / एसीएम (100-15) / 2015 /

रायपुर, दिनांक / 04 / 2015

अधिसूचना

विद्या परिषद की दिनांक 10 मार्च 2015 को संपन्न हुई 100वीं बैठक में पीएच.डी. एवं स्नातकोत्तर थिरीस राष्ट्रिय हेतु मेनुअल को अनुमोदन प्रदान करते हुए विश्वविद्यालय के वेबसाईट पर अपलोड करने का निर्णय लिया गया।

शैक्षणिक सत्र 2014-15 द्वितीय सेमेस्टर में या इसके पश्चात् जमा की जाने वाली समस्त संकल्पों की पीएच.डी एवं स्नातकोत्तर थिरीस अधिसूचित एवं विश्वविद्यालय की वेबसाईट पर उपलब्ध थिरीस राष्ट्रिय मेनुअल के आधार पर तैयार कर विश्वविद्यालय में जमा की जावे।

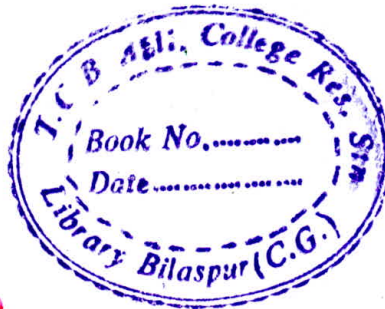
कुलसचिव

क्रमांक / शैल-1 / एसीएम (100-15) / 2015 / 252

रायपुर, दिनांक 21 / 04 / 2015

प्रतिनिधि सूचना एवं आवश्यक कार्यवाही हेतु विहित :-

1. निदेशक शिक्षण, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर एवं उप-कुलसचिव (शैक्षणिक) समन्वय कर कार्य पूर्ण करवाये।
2. निदेशक, अनुसंधान/विस्तार सेवाएं, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
3. लक्ष्मीनारायण, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
4. अधिष्ठाता छात्र कल्याण, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
5. अधिष्ठाता कृषि संकाय, कृषि विश्वविद्यालय, रायपुर।
6. अधिष्ठाता कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
7. अधिष्ठाता, टाकुर चंडीकांत शैक्षिक कृषि महाविद्यालय एवं अनुसंधान केन्द्र, विलासपुर 495 001 / शहीद गुडाधूर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, भागदलपुर 494 005 / राजमोहिनी देवी कृषि महाविद्यालय एवं अनुसंधान केन्द्र, अरिकानपुर, उत्तरांचल / रात कबीर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कवर्धा / कृषि महाविद्यालय, राजनीर चौक / रात कल्याण किड कृषि महाविद्यालय एवं अनुसंधान केन्द्र, भाटापारा, बलौदा बाजार भाटापारा 493118 / कृषि महाविद्यालय, डैडारा / बोरिया / कांकर / रायगढ़ / राजनांदगांव उद्यानिकी महाविद्यालय, राजनांदगांव / जयदेवपुर, श्री अमरापुर कृषि अभियांत्रिकी एवं प्रौद्योगिकी महाविद्यालय, पंडरिया रोड, इ.गां.कृ.वि., मुंगेर 495 334 (छत्तीसगढ़)।
8. प्रयोगक एवं निगराना, कृषि महाविद्यालय, रायपुर / कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
9. उप-कुलसचिव (शैक्षणिक) / उप-लेखनियंत्रक / सूचना एवं जनसंपर्क अधिकारी, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
10. सहायक लेखनियंत्रक - कृषि महाविद्यालय रायपुर / कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
11. सहायक लेखनियंत्रक - विस्तार सेवाएं, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर। कृपया इसे विश्वविद्यालय के वेबसाईट में अपलोड कराए।
12. सहायक कुलपते की के.के.ए.ए.ए. इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।



कुलसचिव रायपुर

Phd. & PG Theses Writing  
Manual 2015-16

# MANUAL OF STYLE FOR THESIS WRITING

Applicable for Post Graduate and  
Doctoral Thesis Work



**INDIRA GANDHI KRISHI VISHWAVIDYALAYA  
RAIPUR - 492 012 (Chhattisgarh)**

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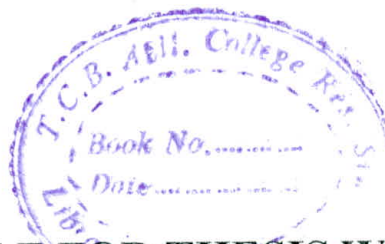
University Technical Cell  
Indira Gandhi Krishi Vishwavidyalaya, Raipur  
website: [www.ignu.edu.in](http://www.ignu.edu.in)

Approved in 100<sup>th</sup> Academic Council Meeting held on 16/03/2015 and notified Vide VV order No. Acd-  
/ACM (100/15), 2015/252 dated 21/04/2015 after incorporation of all amendments made so far.



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# MANUAL OF STYLE FOR THESIS WRITING

## GENERAL GUIDELINES

### Characteristics of Thesis Writing

One factor of greatest importance for the writing of a good thesis is mechanical accuracy and neatness of appearance. Due attention should be given to items such as titles, margins, sub-titles, paragraphs, spacing, tables, graphs, figures and general appearance. There are some important tips of style for writing good thesis.

#### Clearness

- i. Some times people may have little time for reading the thesis and therefore it is essential that they are able to understand quickly and accurately what is presented to them. To be clear, English should be grammatically correct. Violations of English grammar make for obscurity and ambiguity. Due attention should be paid to the importance of concise, clear statement and exact definition to avoid dangerous technical and economical results. Clearness can be achieved by the use of technical terms and everywhere exact word. Uncommon words should be defined in the interest of clearness.
- ii. Clearness is gained by careful and accurate sentence structure in writing. Short declarative sentences should be used. If a sentence contains more than fifteen or twenty words, it is hard to grasp it entirely. Excessive use of the compound sentence 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 each pertinent to the topic of the paragraph.
- iv. A write up will not be clear unless it is arranged in logical order. In other words it must have structural clearness. Each paragraph must have a logical relation to what preceded and what follows and should be linked to the others.
- v. The same type of language should be used through out the write up. Tense sequence of verbs should be observed, uniformity of style aids clearness, which on its mechanical side, is aided by its special forms. Such devisers as sub-titles, marginal outlines, paragraph side headings and drawings are of immense value in making writing clear. These should be used wherever possible.
- vi. Clearness make a thesis easy to understand. It saves the reader from the imitation caused by his attempt to find out the writer's meaning. It gives the feeling of satisfaction.

#### Conciseness

- i. One of the cardinal principles of thesis style is conciseness or compactness. Conciseness of language is gained by using words in their exact meaning and by avoiding round about methods of expressing an idea.

इंदिरा गांधी कृषि विश्वविद्यालय  
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अ.सं.क./शै.स-1/एसीएन (100/15)/2015/

रायपुर, दिनांक . /04/2015

अधिसूचना

विद्या परिषद् की दिनांक 16 मार्च 2015 को संपन्न हुई 100वीं बैठक में पीएच.डी. एवं स्नातकोत्तर थिरीस राइटिंग हेतु मेनुअल को अनुमोदन प्रदान करते हुए विश्वविद्यालय के वेबसाईट पर अपलोड करने का निर्णय लिया गया।

शैक्षणिक सत्र 2014-15 द्वितीय सेमेस्टर में या इसके पश्चात् जमा की जाने वाली समस्त संतानों को पीएच.डी. एवं स्नातकोत्तर थिरीस अधिसूचित एवं विश्वविद्यालय की वेबसाईट पर उपलब्ध थिरीस राइटिंग मेनुअल के आधार पर तैयार कर विश्वविद्यालय में जमा की जावे।

कुलसचिव

अ.सं.क./शै.स-1/एसीएन (100/15)/2015/252

रायपुर, दिनांक 21/04/2015

प्रतिनिधि सूचनार्थ एवं आसपास कार्यवाही हेतु प्रेषित :-

1. निदेशक शिक्षण, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर एवं उप-कुलसचिव (शैक्षणिक) समन्वय कर कार्य पूर्ण करेंगे।
2. निदेशक, अनुसंधान/विकास सेवाएं, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
3. लेखाधिकारी, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
4. अधिष्ठाता एवं कुलसचिव, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
5. अधिष्ठाता कृषि संकाय, कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
6. अधिष्ठाता, कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
7. अधिष्ठाता, लालकृष्ण खेरीराम वैदिक कृषि महाविद्यालय एवं अनुसंधान केन्द्र, बिलासपुर 495 001 / शहीद गुंडाधूर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, जगदलपुर 494 005 / राजमोहिनी देवी कृषि महाविद्यालय एवं अनुसंधान केन्द्र, अदिकापुर, रायपुर / रता कबीर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कवर्धा / कृषि महाविद्यालय, जंजागीर धर्म / इंदिरा गांधी कृषि विश्वविद्यालय एवं अनुसंधान केन्द्र, माटापारा, बलौदा बाजार माटापारा 493118 / कृषि महाविद्यालय, मेमसा / कोरिया / कांकेर / रायगढ़ / राजनांदगांव उद्यानिकी महाविद्यालय, राजनांदगांव / जगदलपुर / बी.एस.एस. कृषि अभियांत्रिकी एवं प्रौद्योगिकी महाविद्यालय, पंडरिया रोड, इ.गां.कृ.वि. मुंगेली 495 333 (छत्तीसगढ़)।
8. आस्थापक एवं दिनांकपाल, कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
9. उप-कुलसचिव (स्थापना) / उप-लेखाधिकारी / सूचना एवं जनसंपर्क अधिकारी, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
10. आस्थापक, लेखाधिकारी - इंदिरा महाविद्यालय रायपुर / कृषि अभियांत्रिकी संकाय, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।
11. सर्वे प्रभारी, विश्वविद्यालय विकास, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर। कृपया इसे विश्वविद्यालय के वेबसाईट में अपलोड करें।
12. वार्षिक वृत्तवृत्ति एवं के.ए.एस. आस्थापक, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर।



कुलसचिव 21/4/15



- 6
- ii. Certain mechanical devices to secure conciseness much used in writing. Such methods as tabular statements of static phrase outlines and even illustrations all help to make the writing of thesis not only more attractive and intelligible but also more concise.

### **Completeness**

- i. Completeness is a characteristic of thesis writing that demands attention. A letter, a report and specially set of specifications or a contract should contain all the information which the reader must know in order to understand intelligently.
- ii. Thus, writing should contain all the essential material and nothing else. Also the thesis can hardly be called complete in the fullest sense of the term if one part is over emphasized to the detriment of other.
- iii. Therefore, a writer should observe proper proportion. A complete treatment of the subject leaves the reader satisfied and in a mood to receive the writer's ideas.

### **Accuracy:**

- i. The mechanics of writing also demands accuracy. Margins, paragraph, indentation, spacing and sectioning should be accurately and carefully done in writing, because they speak accuracy in matter as well.
- ii. The writer should write so accurately that he would not have to fear of misinterpretations. Such matters as accuracy of address, spelling of names, dates, places and references tap are an added importance especially for thesis writing.

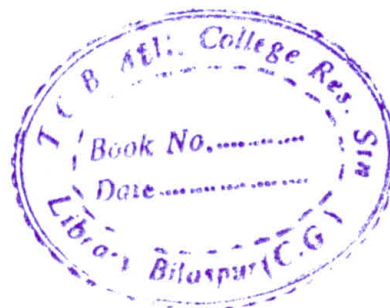
### **Organization**

- i. The thesis writing must have coherence, must develop from logical beginning to a logical conclusion.
- ii. Abrupt changes in thought, plan less execution and unwarranted conclusion have no place in thesis writing in general. The progress of presentation should start from the known to the unknown, from a statement of the problem to the solution proposed. For example, a laboratory report begins with apparatus and method and ends with result.

Organization may be secured by using a plan based on chronological order, or the sequence of events over a period of time. It may also be secure by following a process step by step. Such an order would begin with raw material and end with the finished product.

### **Unity**

- i. Unity in writing closely linked with the matter of careful organization, means that a matter shall deal with one subject at a time.
- ii. Unity in the sentence demands that one sentence develop one thought such that the unity should not be destroyed by the addition of unrelated thoughts. They may be treated in one paragraph if the topic/sentence makes the matter clear, but it is better style in writing to have new paragraph for every idea, even though the paragraph consists of a single sentence.
- iii. The double message should be avoided in the conclusions and recommendations of thesis. Each conclusion and recommendation of a thesis should deal with a single unified idea.
- iv. To put more than one idea in a single paragraph or section of the conclusions of thesis is confusing to the reader because it does not produce a single unified impression.





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## GENERAL GUIDELINES

### Characteristics of Thesis Writing

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#### Clearness

- i. Some times people may have little time for reading the thesis and therefore it is essential that they are able to understand quickly and accurately what is presented to them. To be clear, English should be grammatically correct. Violations of English grammar make for obscurity and ambiguity. Due attention should be paid to the importance of concise, clear statement and exact definition to avoid dangerous technical and economical results. Clearness can be achieved by the use of technical terms and everywhere exact word. Uncommon words should be defined in the interest of clearness.
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- vi. Clearness make a thesis easy to understand. It saves the reader from the imitation caused by his attempt to find out the writer's meaning. It gives the feeling of satisfaction.

#### Conciseness

- i. One of the cardinal principles of thesis style is conciseness or compactness. Conciseness of language is gained by using words in their exact meaning and by avoiding round about methods of expressing an idea.

**Style**

- i. Style in reference to thesis writing is used in this section in a restricted sense. It does not mean literary style.
- ii. Good style is characterized by the frequent use of curves, drawing, photographs etc. Frequently the ideas can interpret these more quickly than written discourse, and if they are properly explained they add to the attractiveness of a matter.
- iii. Therefore, from the standpoint of style as well as clearness, the use of above should to be encouraged wherever they are practicable. In general, however, the writer should write impersonally. The personal element, the "I" does not enter into his/her work and should not be reflected in his/her writing.
- iv. Thus theses are usually written in the passive voice, third person in general is not good style to write 'I did', 'I went' etc.

A thesis submitted in partial fulfillment of the requirement for the Post Graduate or Doctorate degree should consist of three main parts in order as listed below:

**1. The 'Preliminary Pages' composed of:**

- a) The Cover
- b) Title Page
- c) CERTIFICATE - I
- d) CERTIFICATE - II
- e) ACKNOWLEDGEMENT
- f) CONTENTS
- g) LIST OF TABLES
- h) LIST OF FIGURES
- i) LIST OF SYMBOLS/NOTATIONS
- j) LIST OF ABBREVIATIONS

**2. The 'Main Text Pages' consisting of:**

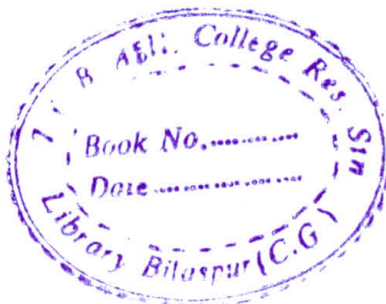
- a) INTRODUCTION
- b) REVIEW OF LITERATURE
- c) MATERIALS AND METHODS
- d) THEORETICAL CONSIDERATIONS (wherever necessary)
- e) RESULTS AND DISCUSSION
- f) SUMMARY AND CONCLUSION

**3. The 'End Pages' including:**

- a) REFERENCES
- b) APPENDIX/APPENDICES
- c) VITA

**THE PRELIMINARY PAGES**

- a) **The Cover page:** This should include the title of thesis, Degree (M.Sc./M. Tech/Ph.D.) Thesis, name of the students (as enrolled in VV), name of



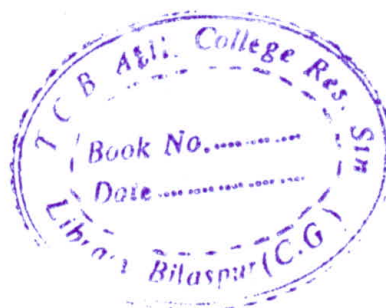




Department, College, its location, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) and year of submission. The alignment/spacing etc should be as in **Sample Sheet 'A'**.

- b) **The Title Page:** This page is next to the cover page and it should include the title of thesis, Thesis submitted to the Indira Gandhi Krishi Vishwavidyalaya, Raipur by (name of the student) in Partial Fulfillment of the requirements for the degree of Master of ..... / Doctor of Philosophy in ..... (name of subject/discipline), month and year and Roll No. and ID No. of the student). The alignment/spacing etc should be as in **Sample Sheet 'B'**.
- c) **CERTIFICATE - I:** This should be in the format as given in **Sample Sheet 'C'**.
- d) **CERTIFICATE - II:** This should be in the format as given in **Sample Sheet 'D'**.
- e) **ACKNOWLEDGEMENT:** In this section the writer should acknowledge by name the help and assistance received by him/her during the course of research and thesis writing, from all the persons/institutions or organizations. The 'Acknowledgement' should normally be limited within two pages.
- f) **TABLE OF CONTENTS:** The contents of the thesis should be given in tabular form listing all the components of the three parts (including all the preliminaries, text main (Chapter titles, headings, sub-headings and sub-sub headings) and the end pages, serially along with the number of the page(must be typed), **exactly** as they appear in the thesis. 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. 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. 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 must 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 must be included in the list in alphabetical order. The type setting and alignment of 'Contents' should be as given in **Sample Sheet 'I'**.

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 I and II, 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 should normally be not more than two lines, type-set in '**inverted pyramid**' pattern. The



## Style

- i. Style in reference to thesis writing is used in this section in a restricted sense. It does not mean literary style.
- ii. Good style is characterized by the frequent use of curves, drawing, photographs etc. Frequently the ideas can interpret these more quickly than written discourse, and if they are properly explained they add to the attractiveness of a matter.
- iii. Therefore, from the standpoint of style as well as clearness, the use of above should to be encouraged wherever they are practicable. In general, however, the writer should write impersonally. The personal element, the "I" does not enter into his/her work and should not be reflected in his/her writing.
- iv. Thus theses are usually written in the passive voice, third person in general is not good style to write 'I did', 'I went' etc.

A thesis submitted in partial fulfillment of the requirement for the Post Graduate or Doctorate degree should consist of three main parts in order as listed below.

### 1. The 'Preliminary Pages' composed of:

- a) The Cover
- b) Title Page
- c) CERTIFICATE - I
- d) CERTIFICATE - II
- e) ACKNOWLEDGEMENT
- f) CONTENTS
- g) LIST OF TABLES
- b) LIST OF FIGURES
- i) LIST OF SYMBOLS/NOTATIONS
- j) LIST OF ABBREVIATIONS

### 2. The 'Main Text Pages' consisting of:

- a) INTRODUCTION
- b) REVIEW OF LITERATURE
- c) MATERIALS AND METHODS
- d) THEORETICAL CONSIDERATIONS (wherever necessary)
- e) RESULTS AND DISCUSSION
- f) SUMMARY AND CONCLUSION

### 3. The 'End Pages' including:

- a) REFERENCES
- b) APPENDIX/APPENDICES
- c) VITA

## THE PRELIMINARY PAGES

- a) **The Cover page:** This should include the title of thesis, Degree (M.Sc./M. Tech/Ph.D.) Thesis, name of the students (as enrolled in VV), name of



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 double line is drawn.

## THE MAIN TEXT

The main body of the thesis 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. **Sample Sheet 'K'**.

### CHAPTER - II

#### REVIEW OF LITERATURE

The pertinent literature projecting the research area/topic of the thesis must be critically reviewed in this chapter. The research work carried out in India and abroad must 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. **Sample Sheet 'L'**.

### CHAPTER - III

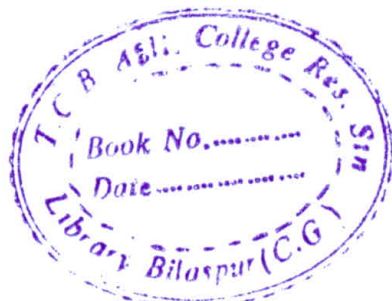
#### MATERIALS AND METHODS

This chapter should describe the experimental design, materials used and the experimental methods/techniques employed, methods/techniques of model development in accomplishing the objectives of the research topic. 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 must 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 research or some experiments, for confirmation of the results or extension of research by a competent research worker. **Sample Sheet 'M'**.

### CHAPTER - IV

#### THEORETICAL CONSIDERATIONS

This chapter is included wherever applicable, usually in engineering disciplines. **Sample Sheet 'N'**.







## CHAPTER - V

### RESULTS AND DISCUSSION

This chapter forms the core of the thesis. 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 must be discussed considering the variables/treatments employed. Then the results must 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. **Sample Sheet 'O'**.

## CHAPTER - VI

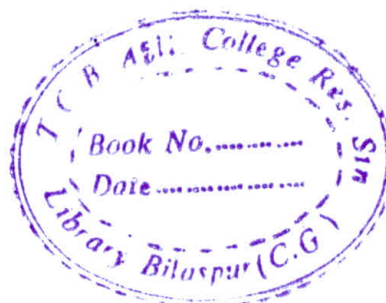
### SUMMARY AND CONCLUSIONS

The 'Summary' should condense the thesis in its entirety. While summarizing the thesis, it should be kept in mind that a summary is always at the end of main chapters of the thesis; 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). **Sample Sheet 'P'**.

### THE TEXT FORMAT

A Thesis should be typed on bond paper 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 should be mistake-free and preferably without corrections or inserts in ink. The line spacing must 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, except the cover and title pages, must be numbered (no hand written). All the preliminary pages should be numbered in small Roman numeral at bottom centre of the page (Certificate - I (one page), Certificate - II (one page), Acknowledgement (two pages), Contents (one or two pages), List of Tables (one or two pages), List of Figures (one or two pages), List of Symbols (one or two pages) and List of Abbreviations (one or two pages) on



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 double line is drawn.

## **THE MAIN TEXT**

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

### **CHAPTER - I**

#### **INTRODUCTION**

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### **CHAPTER - III**

#### **MATERIALS AND METHODS**

This chapter should describe the experimental design, materials used and the experimental methods/techniques employed, methods/techniques of model development in accomplishing the objectives of the research topic. 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 must 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 research or some experiments, for confirmation of the results or extension of research by a competent research worker. **Sample Sheet 'M'**.

### **CHAPTER - IV**

#### **THEORETICAL CONSIDERATIONS**

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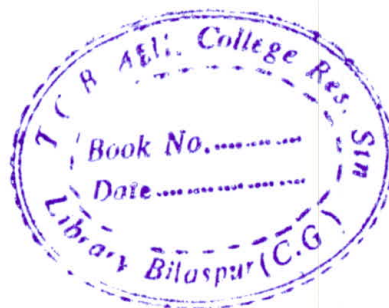
pages i, ii, iii and iv, v/vi, vi/vii, vii/viii, viii/ix and ix/x respectively. The main text and the ending pages should be typed in consecutive Indian (Arabic) numerals in top margin right aligned, starting at 1 from the first page of Introduction and ending on last page (Vita). The number on the starting 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 new Roman 16 point bold font, below the chapter No. in single space, after which a double 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, Theoretical considerations (wherever necessary), Results and Discussion should be written following a fixed chronological numbering system as illustrated in the Table of contents (**Sample Sheet 'E'**). The type setting and alignment of various headings in the Chapters shall be as given in **Sample Sheet 'J'**.

The serial numbering of Tables and Figures should be as per their appearance in respective Chapters (as shown 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). Like wise 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 (example: Gram is represented by g, gm, Gm or G).

The PG student learns the art of referencing viz. literature search, reviewing and the method of citations in text (in different Chapters of main body of thesis) and under References in compulsory supporting course VLB 611: Biological Literature and Reference Work. This course has been made mandatory for all the PG students in the VV in order to make them well acquainted with '**Scientific Report Writing**' including, research articles, project reports, review articles and thesis. In text when a report/research work of other authors is cited it should be as follows (examples are given).







**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 must be italicized (*et al.*). In fact, all the words alien to English must 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:**

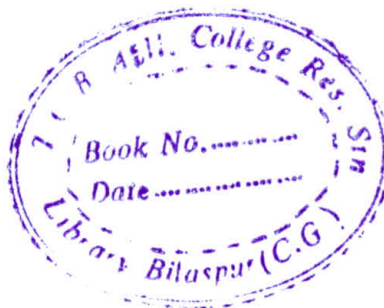
The citation should be in the chronological order under separate paragraphs.

**THE END PAGES**

The end pages include the sections References, Appendix/Appendices and Vita.

**REFERENCES**

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



pages i, ii, iii and iv, v/vi, vi/vii, vii/viii, viii/ix and ix/x respectively. The main text and the ending 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.

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Gburek, W. J., Sharpley, A.N., Heathwaite, L., and Folmar, G.J. 2000. Phosphorus management at watershed scale: A modification on Phosphorous index. *J. Environ. Qual.*, 29:130-144.

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. *Int. J. Remote Sensing*, 12(11): 2205-2225.

**References of authors in the same year**

Anand, O.M. and Amar, S. I. 1983 a. Effects of *Jatropha curcas* on calves. *Vet. Pathol.* 20: 656-662. (Its citation is first in the text)

Anand, O.M. and Amar, S. I. 1983 b. Toxicity of *Jatropha curcas* in sheep and goats. *Res. Vet. Sci.* 32: 84-89. (Its citation appears after the above citation in the text) .

Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Williams, J.R. 1998 a. Large area hydrologic modeling and assessment, part I: Model development, *J. of Am. Water Resour. Asso.* 34(1): 73-89.

Arnold, J. G., Srinivasan, R., Muttiah, R.S., and Allen, P.M. 1998 b. Continental scale simulation of hydrologic balance. *J. Am. Water Resour. Asso.* 35(5): 1037-1050.

**Anonymous Reference:**

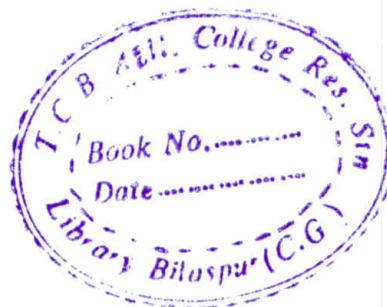
Anonymous. 1994. Drip Irrigation in India. INCID, Ministry of Water Resources, Govt. of India, New Delhi. July, p.1 [In text to be cited as Anon. (1994) or (Anon., 1994)]

Anonymous. 1994. Social changes in Doon Valley by Lab-to-Land programme. *Indian Farming*, Vol. 43(10), 13-18.

**References of same authors in different years must be given in chronological order.**

**Book References**

Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. Glossary of Indian Medicinal plants. 1<sup>st</sup> Edition, I, Council of Scientific and Industrial Research, New Delhi, p. 145.







- Finco, D.R. 1997. Kidney function. In: Kaneko, J.J., Harvey, J.W. and Bruss, M.L. (Eds) *Clinical Biochemistry of Domestic Animals*, 5<sup>th</sup> Edition, Harcourt Brace and Company Asia PTE Ltd., Singapore, : 441- 484.
- Kirtikar, K. R. and Basu, B. D. 1975. Indian Medicinal plants. Vol.III, Bishon Singh and Mahendra Singh, Delhi, : 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, : 337-349.
- Michael, A.M. 1978. Irrigation: Theory and Practice. 4<sup>th</sup> Edition, Vikas Publishing House Pvt. Ltd. New Delhi, : 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, : 12-13.
- Makinde, M.O., Umapathy, E., Akingbemi, B.T., Mandisodza, K.T., Skadhauge, E. and Poomvises, P. 1994. The effect of legume diets on gut morphology and faecal characteristics in weanling pigs. In Ingkaninun, P. (Ed), *Proceedings of 13<sup>th</sup> International Pig Veterinary Society Congress*, Bangkok, Thailand, Bangkok University Press, Bangkok, : 26-30.
- 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, : 105-125.

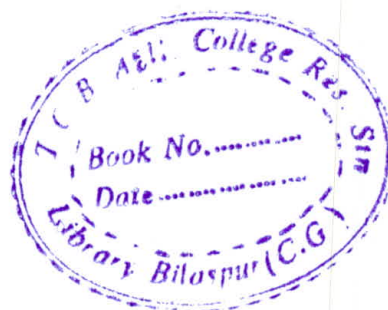
#### **Theses**

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

**The page numbering of References should be in continuation from the last page of Summary and Conclusion.**

#### **Appendix/Appendices**

This section includes 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 etc. If there are more than one Appendix, the Appendices are numbered serially as Appendix - A, Appendix - B, Appendix - C and so. The page numbering of Appendices should be in continuation from the last page of References.



#### Journal reference:

- Duggan, D.J., Hooke, K.F., Noll, R.M. and Kwan, K.C. 1975. Enterohepatic circulation of Indomethacin and its role in intestinal irritation. *Biochem. Pharmacol.*, 24: 1749 – 1754.
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#### Book References

- Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. Glossary of Indian Medicinal plants. 1<sup>st</sup> Edition, I, Council of Scientific and Industrial Research, New Delhi, p. 115.

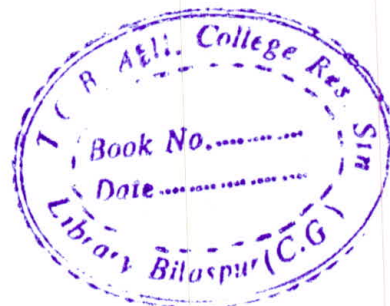


### Vita

This gives the Resume, in brief, of the author. It is the short biography of the student including date and place of birth, academic background and achievements (including honours/fellowships, number of papers published etc) and professional standing. The full contact address and phone numbers, if any, must also be included. The resume in thesis may help in employment placement of author. It should be of one page only, presented in a paragraph. This forms the last page of the thesis and numbered in continuation of last page of Appendices. The author must put his/her signature at the end of vita and giving the address below the signature.

### ABSTRACT

Abstract is different from Summary. The abstract should be informative enough to give a clear idea of the thesis content, when read independently. An abstract should be understood in the absence of the thesis and hence it is a micro-thesis (Summary is read after the main chapters of the thesis). Summary cannot go without the main text; whereas, an abstract can go without the thesis or main text. The 'Abstract' is submitted enclosed along with the 'Application' for submission of the thesis and with the 'Panel of Examiners' by the Major Advisor to the Director of Instructions of the VV. The typical format of an Abstract is given in 'Sample Sheet M'







SAMPLE SHEET "A"

**RISK ASSESSMENT FOR OPTIMAL DROUGHT  
MANAGEMENT OF AN INTEGRATED RESOURCES  
SYSTEM USING A GENETIC ALGORITHM**

(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)

**M.Sc. (Ag)/ M.Tech. (Agril. Engg.)/Ph.D. Thesis**  
(Times New Roman, font size 14 pt., bold, centre aligned)

**by**

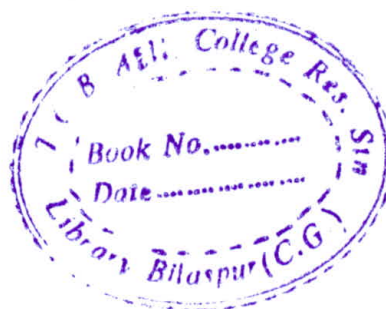
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**Anil Kumar Mishra**

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**DEPARTMENT OF .....**  
**COLLEGE.....**  
**FACULTY .....**  
**INDIRA GANDHI KRISHI VISHWAVIDYALAYA**  
**RAIPUR (Chhattisgarh)**  
**2015**

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## Vita

This gives the Resume, in brief, of the author. It is the short biography of the student including date and place of birth, academic background and achievements (including honours/fellowships, number of papers published etc) and professional standing. The full contact address and phone numbers, if any, must also be included. The resume in thesis may help in employment placement of author. It should be of one page only, presented in a paragraph. This forms the last page of the thesis and numbered in continuation of last page of Appendices. The author must put his/her signature at the end of vita and giving the address below the signature.

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SAMPLE SHEET "B"

**RISK ASSESSMENT FOR OPTIMAL DROUGHT  
MANAGEMENT OF AN INTEGRATED RESOURCES  
SYSTEM USING A GENETIC ALGORITHM**

(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**

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

**Submitted to the**

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

**Indira Gandhi Krishi Vishwavidyalaya, Raipur**

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

**by**

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

**Anil Kumar Mishra**

(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)

**Master of .....**

**Doctor of Philosophy**

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

**in**

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

**Soil Science**

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

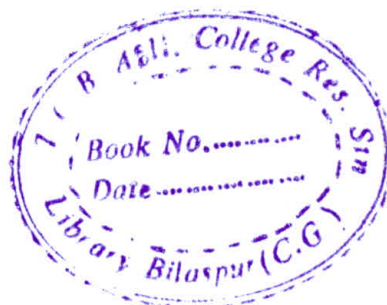
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ID No. Ag./99/59

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**DECEMBER, 2015**

(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 entitled "**Risk assessment for optimal drought management of an integrated resources system using a genetic algorithm**" submitted in partial fulfillment of the requirements for the degree of **Master/Doctor of .....** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by **Anil Kumar Mishra** under my/our guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma or has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him/her.

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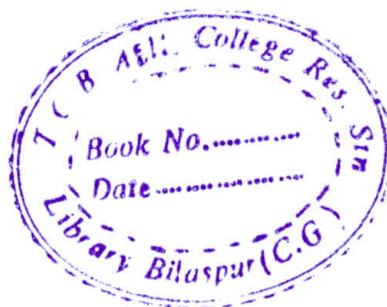
**Co-Chairman**  
(Wherever applicable)  
Date:

**Chairman**

**THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE**  
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Chairman	(Dr. _____ )	_____
Co-Chairman	(Dr. _____ )	_____
Member	(Dr. _____ )	_____
Member	(Dr. _____ )	_____
Member	(Dr. _____ )	_____

(Times New Roman, font size 12 pt., justified)



SAMPLE SHEET "B"

**RISK ASSESSMENT FOR OPTIMAL DROUGHT  
MANAGEMENT OF AN INTEGRATED RESOURCES  
SYSTEM USING A GENETIC ALGORITHM**

(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**

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

**Submitted to the**

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

**Indira Gandhi Krishi Vishwavidyalaya, Raipur**

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

**by**

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

**Anil Kumar Mishra**

(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)

**Master of .....**

**Doctor of Philosophy**

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

**in**

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

**Soil Science**

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

Roll No. 6315

ID No. Ag./99/59

(Times New Roman, font size 14, not bold)

**DECEMBER, 2015**

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

SAMPLE SHEET "D"

**CERTIFICATE - II**

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

This is to certify that the thesis entitled "**Risk assessment for optimal drought management of an integrated resources system using a genetic algorithm**" submitted by **Anil Kumar Mishra** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfilment of the requirements for the degree of **Master /Doctor of.....** in the Department of ..... has been approved by the external examiner and Student's Advisory Committee after oral examination.

Signature External Examiner  
(Name )

Date:

**Major Advisor**

\_\_\_\_\_

**Head of the Department**

\_\_\_\_\_

**Faculty Dean**

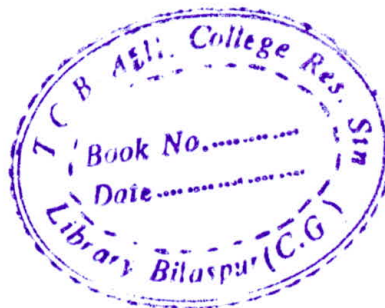
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**Approved/Not approved**

**Director of Instructions**

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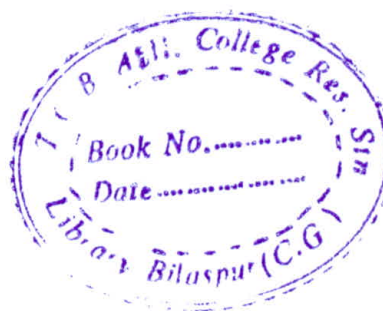


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(Times new roman, 16 pt., Bold, right align)

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SAMPLE SHEET "D"

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Signature External Examiner  
(Name \_\_\_\_\_)

Date:

Major Advisor

\_\_\_\_\_

Head of the Department

\_\_\_\_\_

Faculty Dean

\_\_\_\_\_

Approved/Not approved

Director of Instructions

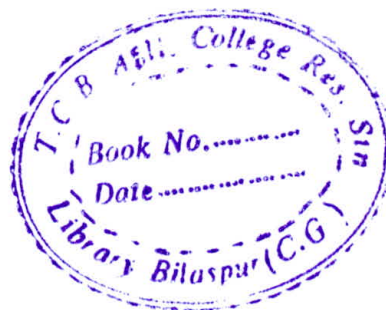
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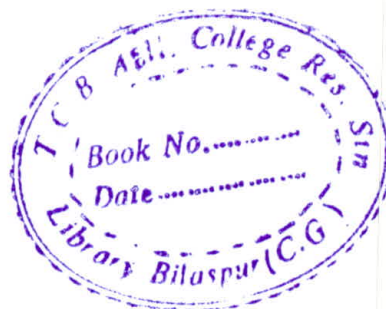
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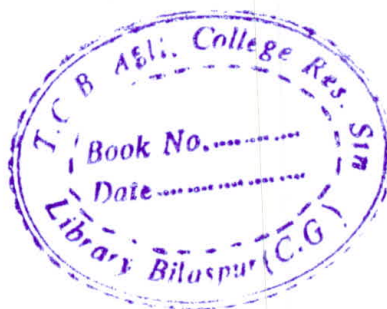
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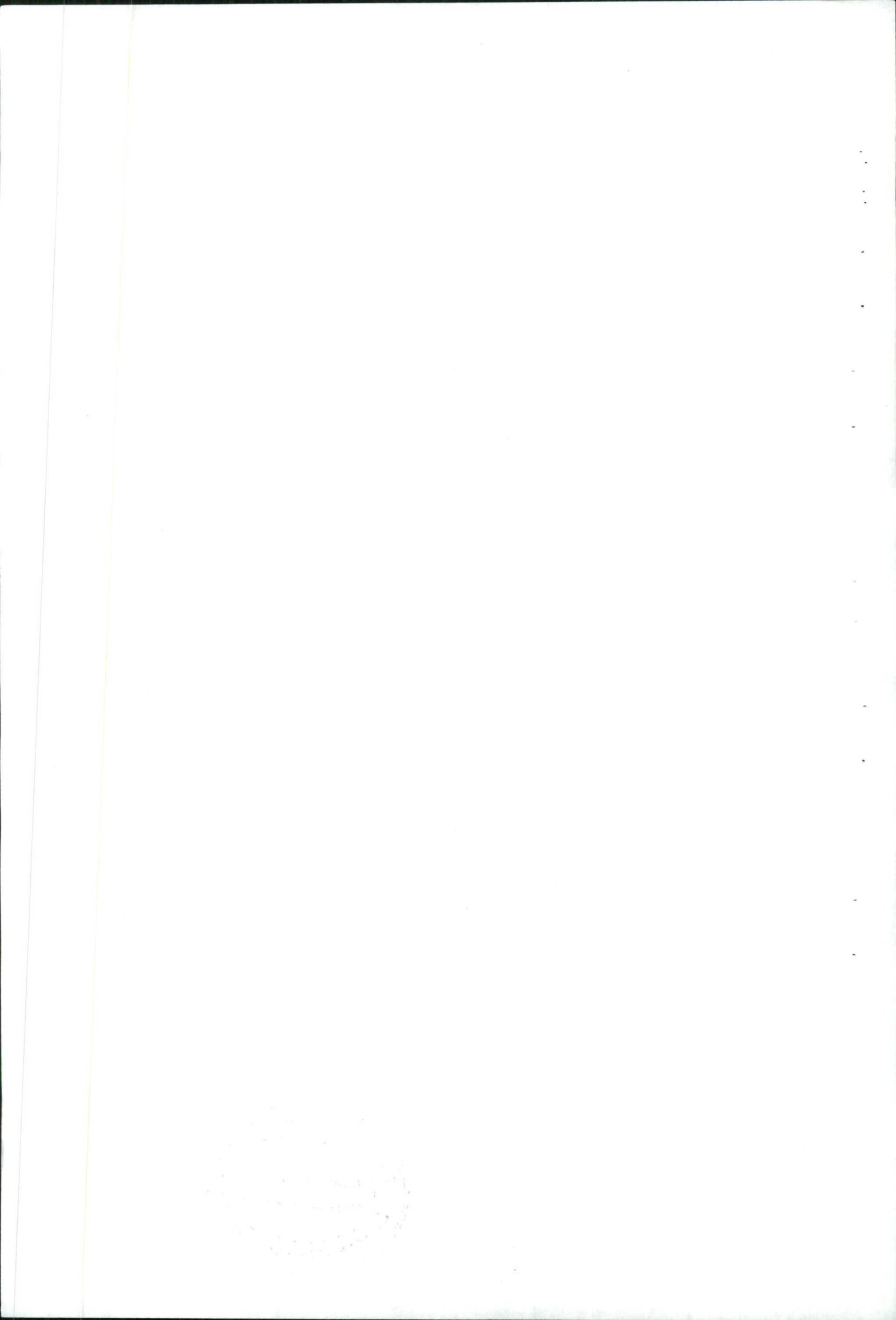
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SAMPLE SHEET " H "

**LIST OF NOTATIONS/SYMBOLS**

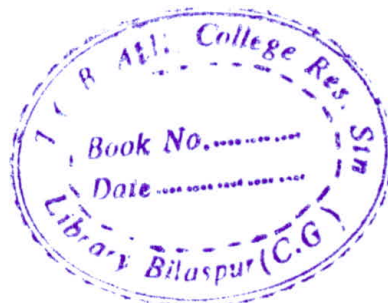
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$A_{ch}$	Cross-sectional area of flow in the channel ( $m^2$ )
$A_{ch,bnkfull}$	Cross-sectional area of flow in the channel when filled to the
$Area$	Sub basin area ( $km^2$ or ha)
$AWC$	Available water capacity (mm)
$C$	Runoff coefficient
$C_{CH}$	Channel cover factor
$C_{USLE}$	USLE cover and management factor
$C_{USLE,mn}$	Minimum value for the cover and management factor for the land cover
$CFRG$	Coarse fragment factor
$CN$	Curve number
$DA$	HRU drainage area ( $km^2$ )
$E_a$	Actual amount of evapotranspiration (mm)
$E_{ch}$	Evaporation from the reach ( $m^3$ )
$E_o$	Potential evapotranspiration ( $mm\ d^{-1}$ )
$E$	Maximum soil water evaporation (mm)
$E_t$	Transpiration rate ( $mm\ d^{-1}$ )
$E_{N\ sed}$	N enrichment rate
$E_{P\ sed}$	P enrichment rate
$E_{NS}$	Nash-Sutcliffe simulation efficiency
$FC$	Water content of soil profile at field capacity (mm)
$FC_{ly}$	Water content of layer $ly$ at field capacity (mm)
$G$	Heat flux density to the ground ( $MJ\ m^{-2}\ d^{-1}$ )
$H_{day}$	Solar radiation reaching ground ( $MJ\ m^{-2}\ d^{-1}$ )
$H_{MX}$	Maximum possible solar radiation ( $MJ\ m^{-2}\ d^{-1}$ )
$H_{net}$	Net radiation on day ( $MJ\ m^{-2}\ d^{-1}$ )
$H_o$	Saturated thickness normal to the hill slope at the outlet (mm/mm)
$H_{phosyn}$	Intercepted photosynthetically active radiation ( $MJ\ m^{-2}\ d^{-1}$ )
$HI_{trg}$	Target harvest index

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SAMPLE SHEET " G"

**LIST OF FIGURES**

(Times new roman ,16 pt., Bold, right align)

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

SAMPLE SHEET " I "

**LIST OF ABBREVIATIONS**

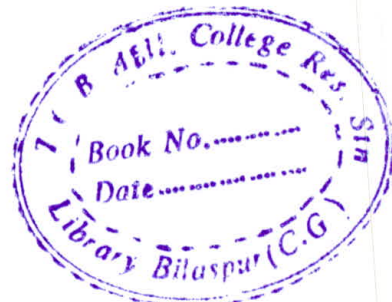
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A, B, C & D	Hydrological soil groups
AGNPS	Agricultural Nonpoint Source
AMC	Antecedent Moisture Condition
ANSWERS	Areal Nonpoint Source Watershed Environment Response Simulation
ARS	Agricultural Research Services
ASAE	American Society of Agricultural 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
ERDAS	Image processing software from ERDAS Inc.
ET	Evapotranspiration
FC	Field cultivator
FCC	False Colour Composite

---

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





SAMPLE SHEET "J"

**THESIS ABSTRACT**

---

- a) Title of the Thesis:
- b) Full Name of the Student:
- c) Major Subject:
- d) Name and Address of the:  
Major Advisor
- e) Degree to be Awarded:

Signature of the Student

Signature of Major Advisor

Date: \_\_\_\_\_

Signature of Head of the Department

---

**ABSTRACT**

(In 2-3 pages typed in one and half line spacing in Times New Roman, font size 12 pt. with the one inch margins on four sides of the page)



## 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
ERDAS	Image processing software from ERDAS Inc.
ET	Evapotranspiration
FC	Field cultivator
FCC	False Colour Composite

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SAMPLE SHEET "K"

**CHAPTER - I**

**INTRODUCTION**

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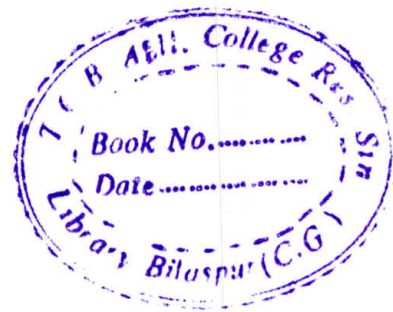
Water is a most precious natural resource and a universal asset. Sustainable management of natural resources on watershed basis is essential for maintaining the fragile balance between the productivity. Alternate agricultural practices, crop rotation, use of bio-fertilizers, energy efficient farming methods and reclamation of underutilized land are some of the components in the said direction.

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The specific objectives of the present study are:

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CHAPTER - II

REVIEW OF LITERATURE

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**2.1 Models for Watershed Hydrology**

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**2.1.1. Classifications of Models**

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**2.1.2. Hydrologic and water quality models**

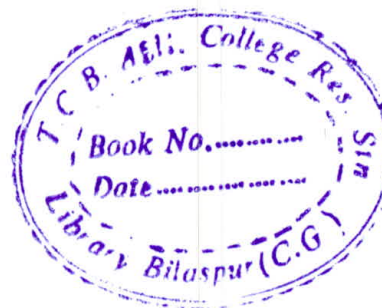
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**2.1.2.1. Field scale models**

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**CHAPTER - I**

**INTRODUCTION**

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Water is a most precious natural resource and a universal asset. Sustainable management of natural resources on watershed basis is essential for maintaining the fragile balance between the productivity. Alternate agricultural practices, crop rotation, use of bio-fertilizers, energy efficient farming methods and reclamation of underutilized land are some of the components in the said direction.

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**METHODS AND MATERIALS**

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**3. 1 The Study Area**

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**3.1.1. Physiography**

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**3.1.2. Climate**

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**3.1.2.1. Winter**

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**3. 2 Data Acquisition**

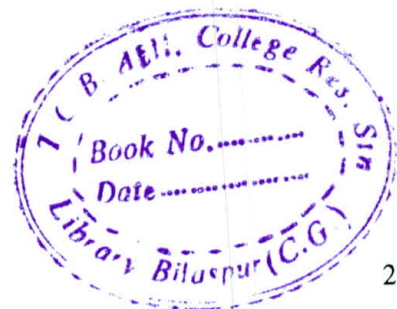
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**3. 3 Hardware and Software Used**

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## THEORETICAL CONSIDERATIONS

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This chapter deals with the theoretical consideration related to the model. The brief description of various components and the mathematical relationships used to simulate the different processes and their interactions in the model as described by Neitsch et al. (2001 b) are considered..

### 4.1 Components of Subbasin

#### 4.1.1 Hydrology

The land phase of the hydrologic cycle is based on the water balance equation:

$$SW_t = SW_o + \sum_{i=1}^t (R_{day} - Q_{surf} - E_a - w_{seep} - Q_{gw}) \quad (4.1)$$

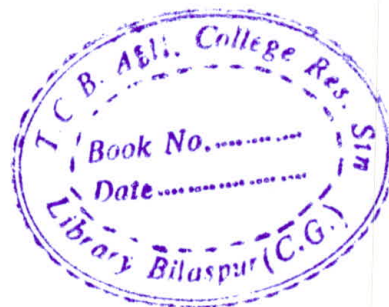
where,  $SW_t$  is the final soil water content (mm),  $SW_o$  is the initial soil water content (mm),  $t$  is the time (days),  $R_{day}$  is the amount of precipitation (mm),  $Q_{surf}$  is the amount of surface runoff  $i$  (mm),  $E_a$  is the amount of evapotranspiration (mm),  $w_{seep}$  is the amount of percolation and bypass flow exiting the soil profile bottom (mm), and  $Q_{gw}$  is the amount of return flow (mm), and  $i$  is the index for day.

##### 4.1.1.1 Surface runoff

Surface runoff is predicted for daily rainfall by using SCS curve number equation (USDA-SCS, 1972)

$$Q_{surf} = \frac{(R_{day} - I_a)^2}{(R_{day} - I_a + S)} \quad (4.2)$$

where,  $Q_{surf}$  is the accumulated runoff or rainfall excess (mm),  $R_{day}$  is the rainfall depth for the day (mm),  $I_a$  is the initial abstractions which includes surface storage, interception and infiltration prior to runoff (mm), and  $S$  is the retention parameter (mm).



**METHODS AND MATERIALS**

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**3. 1 The Study Area**

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**3.1.1. Physiography**

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**RESULTS AND DISCUSSION**

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The results obtained from calibration, validation and sensitivity analysis of model for prediction of runoff, sediment yield and nutrients losses at the outlet of the Banikdih watershed are presented in this chapter. SWAT2000 is applied for the identification and prioritization of critical sub-watersheds along with the recommended management practices.

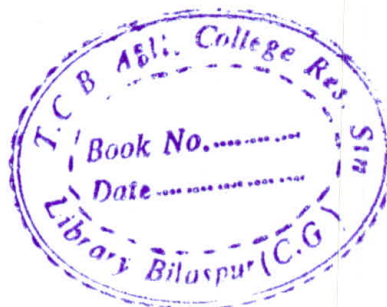
**5.1 Model Calibration**

In the present study, daily values of surface runoff and sediment yield recorded at the outlet of the study watershed during monsoon season (June to September) of 1998 were used for calibration of the model. The model was calibrated using different values of input parameters followed by several simulation runs.

Only one weather data generator file was taken because of presence of only one gauging station in the entire watershed. Daily observed rainfall and temperature data of 1998 were used for calibration of the model. Hargreaves method was selected for computation of ET since it gave better results as per the availability of the data. The interpretations of the results are described as below.

**5.1.1 Surface runoff**

The time series of the observed and simulated daily runoff of the study watershed for calibration period (June 1 to September 30, 1998) were compared graphically. It was observed that the time to peaks of simulated runoff hydrograph matched well with its observed values throughout the season. For the calibration period the trend of simulated daily runoff was similar to that of observed values. For high magnitude events the model generally over predicted the runoff where



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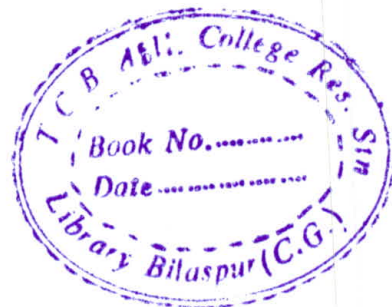
**SUMMARY AND CONCLUSIONS**

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Watershed management is a process of formulating and carrying out the course of action involving the manipulation of its natural system to achieve specific objectives, i.e. control of soil erosion and land degradation, reclamation and rehabilitation of waste and degraded land, land use revision consistent with land capability, optimal management of croplands, grasslands and forests and conservation and management of water resources. Prediction of runoff and sediment yield is necessary for the design of conservation structures to reduce the ill effects of sedimentation and to select the priority watersheds for implementing conservation and management programs with the limited available resources. The information is also needed to evaluate the impact of watershed management program.

**CONCLUSIONS**

- Land use/land cover information generated from IRS-1D LISS-III images resulted in user's and producer's accuracies up to 92%, Kappa coefficient up to 0.91 and overall classification accuracy up to 92%.
- The curve number values for the study watershed were generated accurately with weighted average of 77 using IRS-1D LISS-III images and GIS. Drainage basin and channel attributes can successfully be extracted and updated using IRS-1D LISS-III images and GIS in a time and cost effective manner.
- Manning's 'n' for overland, main channel and tributary channel flows were found to be 0.068, 0.190 and 0.210, respectively. The annual sediment yield is inversely related to the over land and channel roughness coefficients (Manning's 'n').





**RESULTS AND DISCUSSION**

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

Statistical parameters	NO <sub>3</sub> -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 <sup>2</sup>	0.830		0.820		0.810		0.910	
RMSE (kg/ha)	0.007		0.011		0.006		0.001	
D <sub>v</sub> %	-17.060		-11.700		12.120		16.390	

Obs = Observed, Simu = Simulated

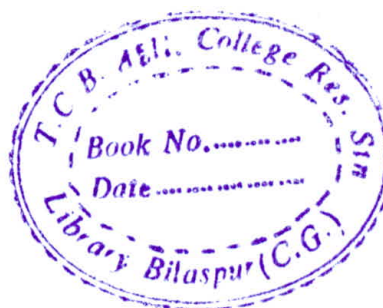
This is a Second Table of Chapter - III (Materials and Methods)

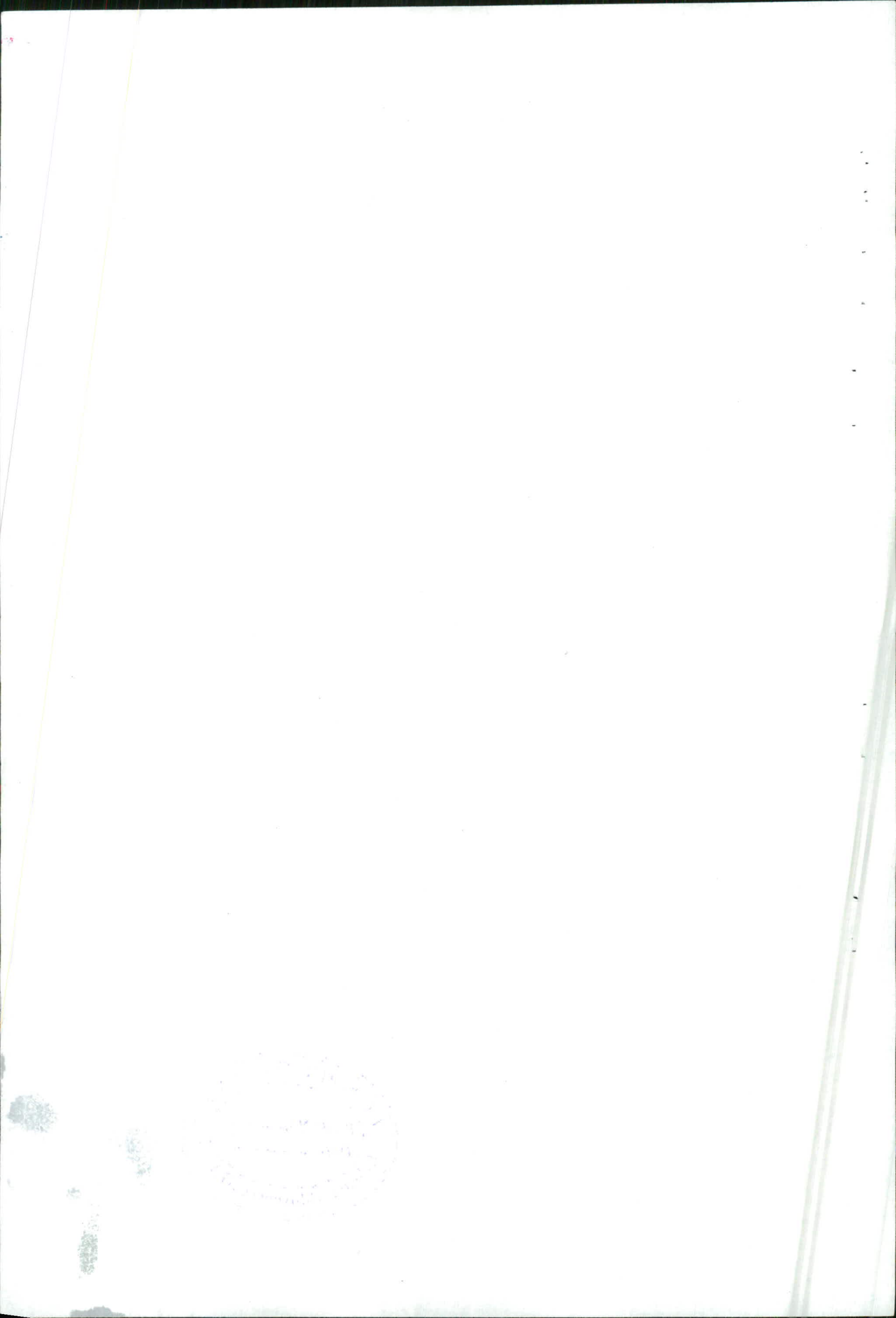
Table 4.4: Parameters used for model calibration

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	'revap' coefficient	0.00	0.00 - 1.00
9	'revap' storage	0.00	0.00 - 500.00
10	Channel erodibility factor	0.50	0.05 - 1.00
11	Channel cover factor	0.80	0.001 - 1.00
12	Base flow alpha factor	0.08	0.00 - 1.00

This is a Fourth Table of Chapter - IV (Results and Discussion)

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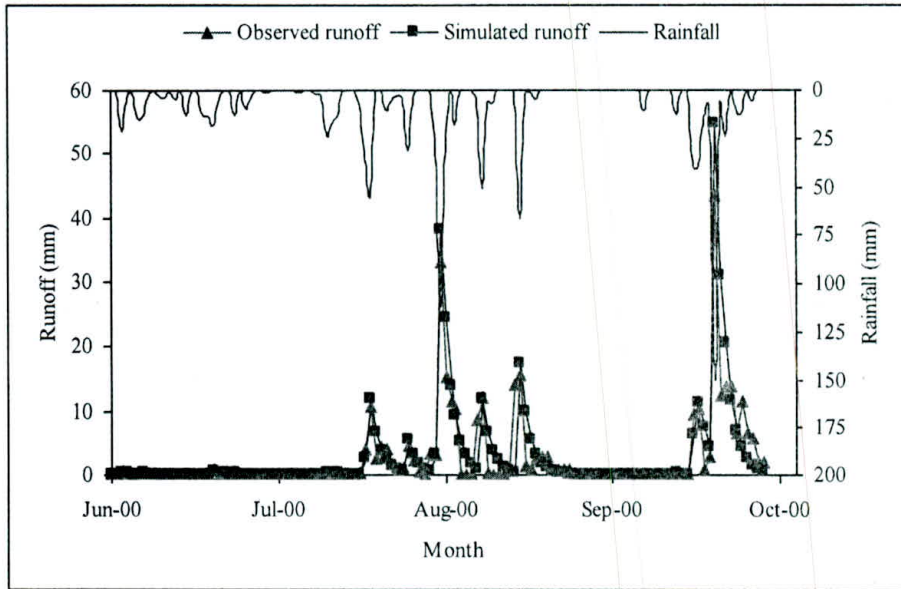


Fig. 4.4 : Observed and simulated runoff hydrograph

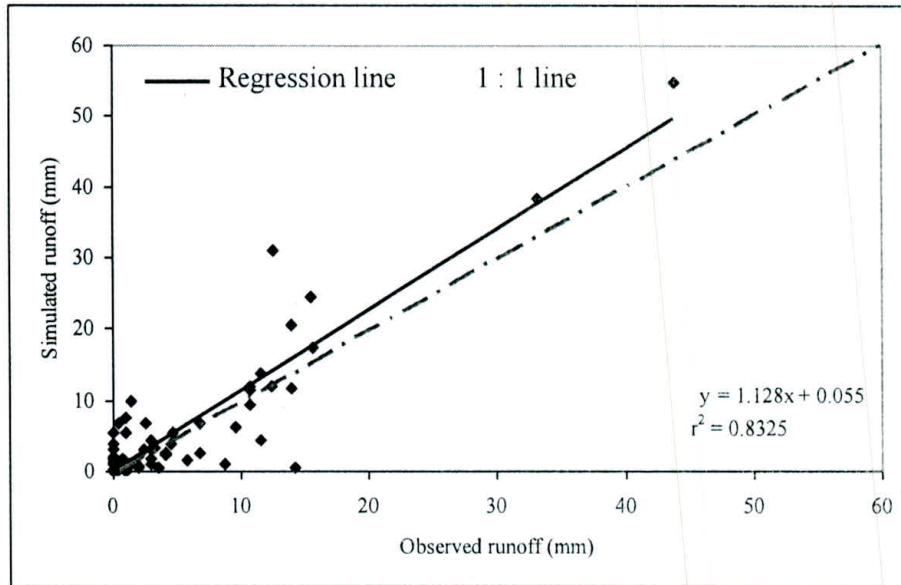
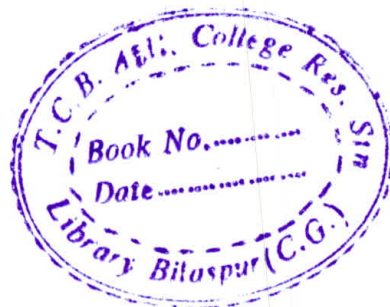


Fig. 4.5 : Comparison between observed and simulated daily runoff

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

Statistical parameters	NO <sub>3</sub> -N		Organic N		Soluble P		Organic P	
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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	
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RMSE (kg/ha)	0.007		0.011		0.006		0.001	
D, %	-17.060		-11.700		12.120		16.390	

Obs = Observed, Simu = Simulated

This is a Second Table of Chapter - III (Materials and Methods)

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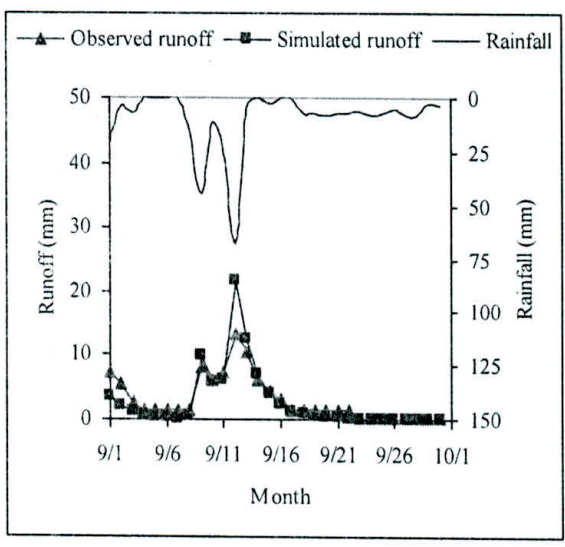


Fig. 5.9 Observed and simulated runoff hydrograph for model calibration (September 1998)

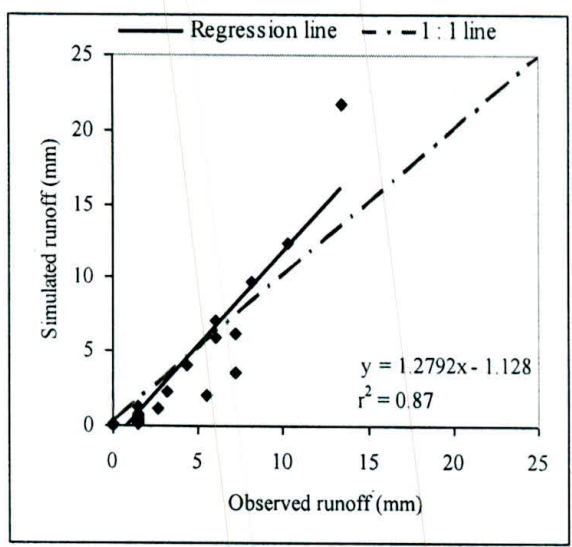
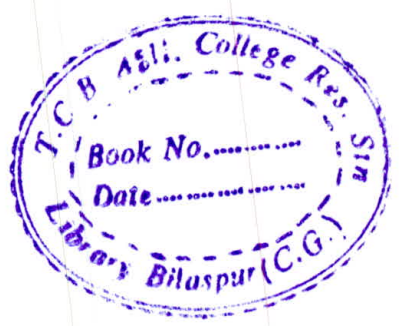


Fig. 5.10 Comparison between observed and simulated daily runoff for model calibration (September 1998)

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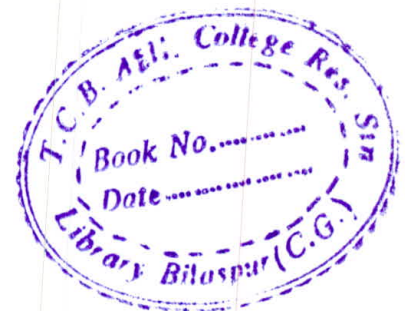


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SAMPLE SHEET "S"**APPENDIX - A**

Table : Basin input data file (.bsn)

<b>Input parameters</b>	<b>Values</b>
Area of the watershed (km <sup>2</sup> )	88.743
Concentration of nitrogen in rainfall (mg N/L)	1.000
Surface runoff lag coefficient	4.000
Peak rate adjustment factor for sediment routing in the tributary channels	1.000
Peak rate adjustment factor for sediment routing in the main channel	1.000
Linear parameter for calculating the maximum amount of sediment	0.001
Exponent parameter for calculating sediment re-entrained in channel	1.000
Reach evaporation adjustment factor	1.000
Leaf area index at which no evaporation occurs from water surface	3.000
Initial soil water storage expressed as a fraction of field capacity water content	0.000
Rate factor for humus mineralization of active organic nutrients (N and P)	0.003
Nitrogen uptake distribution parameter	20.000
Phosphorus uptake distribution parameter	20.000
Nitrate percolation coefficient	0.200
Phosphorus percolation coefficient (10 m <sup>3</sup> /Mg)	10.000
Phosphorus soil partitioning coefficient (m <sup>3</sup> /Mg)	175.000
Phosphorus availability index	0.400
Residue decomposition coefficient	0.050



SAMPLE SHEET "R" (b)

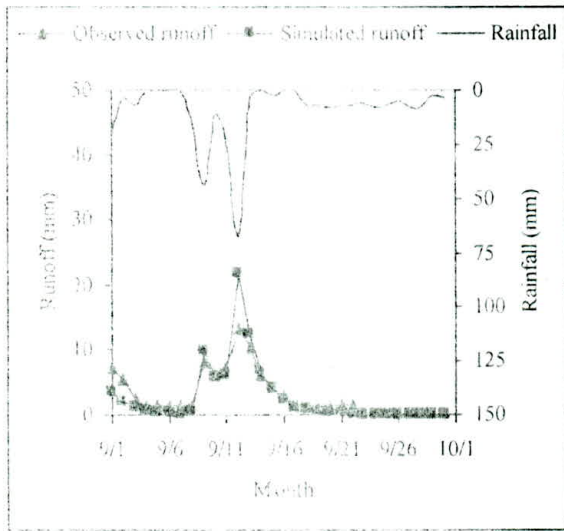


Fig. 5.9 Observed and simulated runoff hydrograph for model calibration (September 1998)

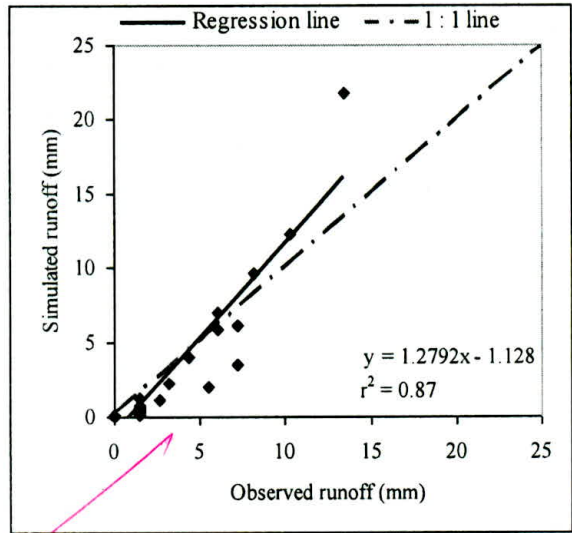


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(Note: If the size of the graphs is small then two graphs can be placed in a parallel manner as shown above to ensure the page economy, provided the presentation of the graphs and text containing on the graphs is clear and readable)



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RESUME

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Permanent address :

Academic Qualification:

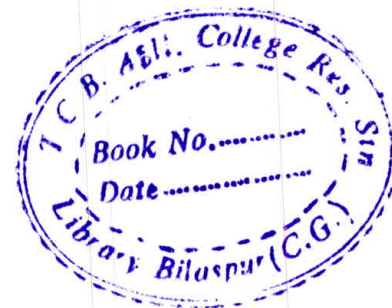
Degree	Year	University/Institute

Professional Experience (If any) :

Membership of Professional Societies (If any) :

Awards / Recognitions (If any) :

Publications (If any): In numbers only



Signature

(Note: The length of resume should not exceed more than one page)







SAMPLE SHEET "T"

RESUME

Name :

Date of birth :

Present Address :

Phones

Fax

E. mail

Permanent address :

Academic Qualification:

Degree	Year	University/Institute

Professional Experience (If any) :

Membership of Professional Societies (If any) :

Awards / Recognitions (If any) :

Publications (If any) in numbers only

Signature

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