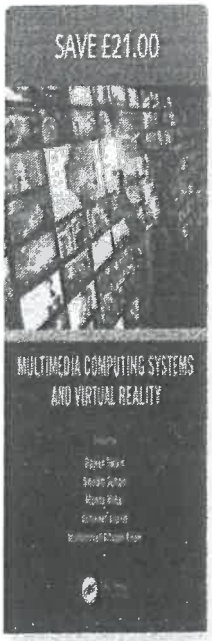

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1st Edition

Multimedia Computing Systems and Virtual Reality

Edited By Rajeev Tiwari, Neelam Duhan, Mamta Mittal, Abhineet Anand, Muhammad Attique Khan

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Hardback	eBook
£84.00	£39.19

ISBN 9781032048239

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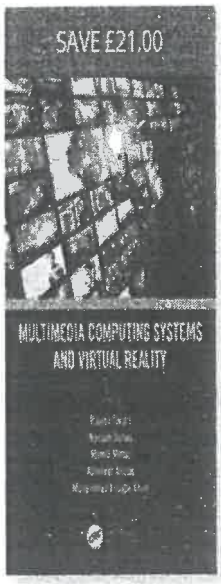

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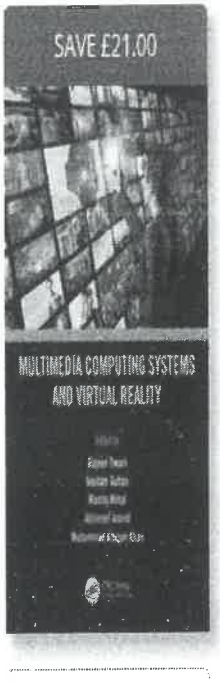

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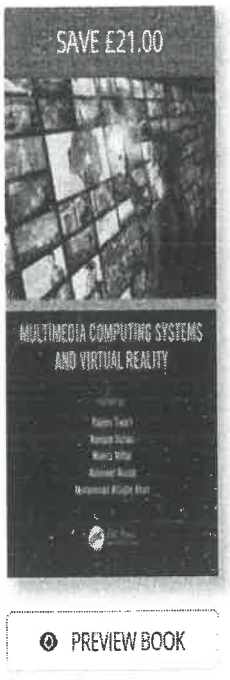

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Mastering
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Dr. G. Shobana
Mrs. Srujana Gorintla
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Paperback ISBN: 978-93-5574-300-8

First Published in October 2022

Published by Walnut Publication (an imprint of Vyusta Ventures LLP)
www.walnutpublication.com

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6834 Cantrell Road #2096, Little Rock, AR 72207, USA

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International House, 12 Constance Street, London E16 2DQ, United Kingdom

Dr. G. Shobana

Dr. G. Shobana currently working as an Associate Professor in the Department of Computer Science and Engineering, NRI Institute of Engineering and Technology (Autonomous), Pothavarapadu, Agiripalli and completed her Ph.D. Acharya Nagarjuna University Nambur, and received her Master's Degree from Acharya Nagarjuna University. She is dedicated to the teaching field for the past 14 years. Published more than 20 papers in national and international journals and conferences. Member of Editorial Board and Reviewer for various International Journals.

Mrs. Srujana Gorintla

Mrs. Srujana Gorintla, currently working as Assistant Professor in the Department of Computer Science and Engineering,KKR & KSR INSTITUTE OF TECHNOLOGY & SCIENCES and completed her M.Tech in JNTU Kakinada, and received her MCA degree from Acharya Nagarjuna University. She is dedicated to the Teaching field for the past 10 years She Published papers in national, and international journals and conferences. She published one Patent in the Indian patents journal and was granted One Innovation Patent on Electric Vehicle charging estimation Device using Machine Learning by Ip, Australia, Australian Government. Patent number: 2021102771

Dr. N. Raghavendra Sai

Dr. N. Raghavendra Sai, is an academician with in-depth knowledge and profound skill set in teaching pedagogy, research, education, and administration. His career experience spans around 15 years, presently he is currently working as an Associate Professor in the Department of Computer Science and Engineering, KL University, Vaddeswaram, and completed his Ph.D. from Bharathiar University Coimbatore, and received his Master's Degree from Acharya Nagarjuna University. He has been a pioneer in teaching and research with a focus on Data Mining, Intrusion Detection systems, Data Modelling, Machine learning, Deep learning, and Cloud computing. He has a profound interest in research and has guided students and published more than 35 research articles in peer-reviewed journals and international conferences of repute. He has also authored textbooks for engineering students. He is also a Member of many Editorial boards and Reviewers for various International journals and received Bharat Excellence Award from FFI New Delhi and many more awards for his research. He has guided 36 P. G Students and 50 U. G Students. His research area is Data Mining Network Security and included Artificial Intelligence. He is highly assionate and Enthusiastic about his teaching.

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ISBN 978-93-5574-300-8
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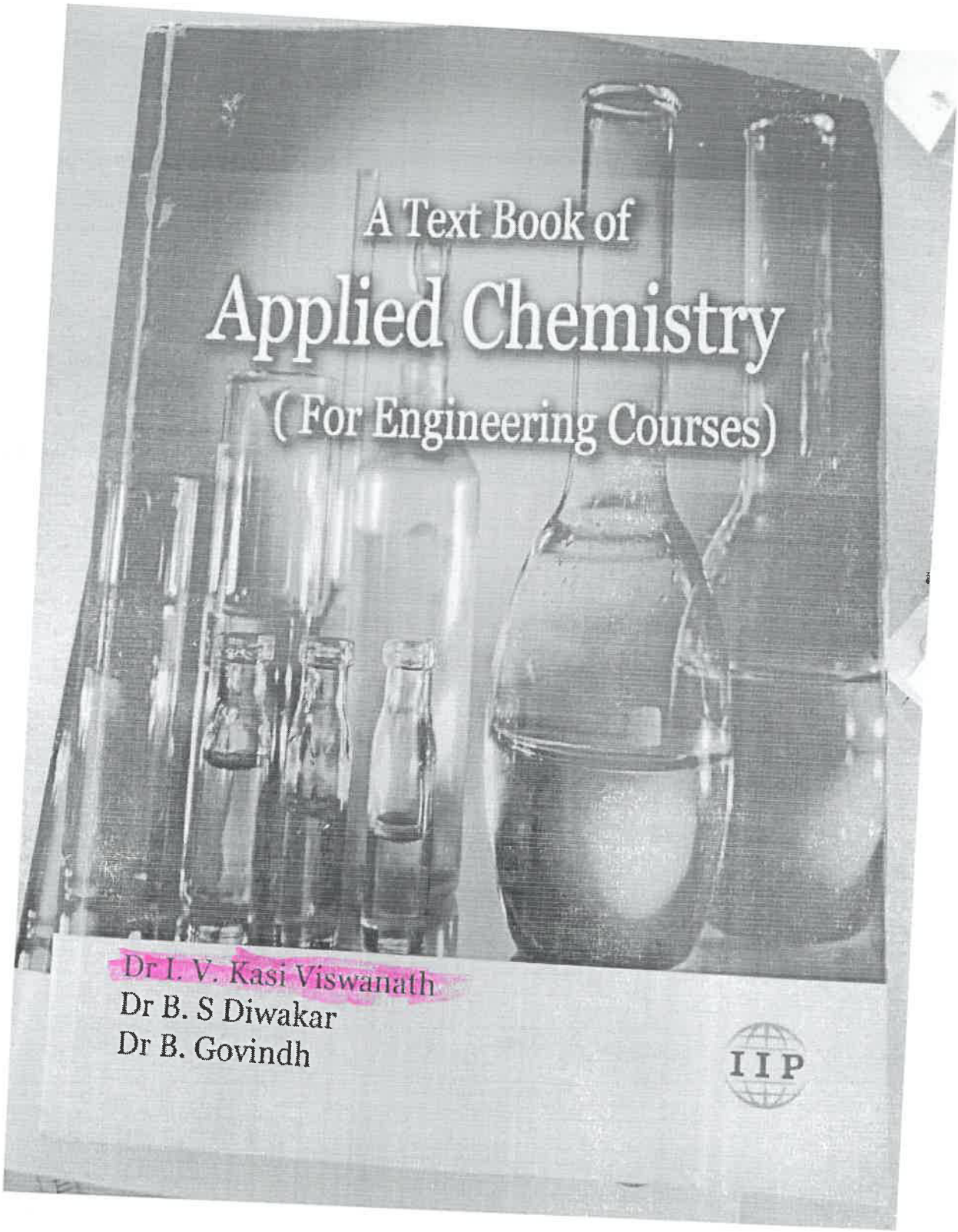
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Edition: First- 2021

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Dr. I. V. Kasi Viswanath, Ph.D from Department of Organic Chemistry. He is currently serving as a potential reviewer for various Scopus and SCI journals.

Dr. Bhagavathula S. Diwakar, M.Sc and Ph.D from Department of Organic Chemistry& FDW, Andhra University. He worked as a Post-Doctoral Research scientist sponsored by FONDECYT (Commission of Science and Technology, Govt. of Chile) postdoctoral project in the Laboratory of Nano-composites.

Dr. Boddeti Govindh, M.Sc and Ph.D from Department of Organic Chemistry & FDW, Andhra University. He is currently serving as a potential reviewer for various Scopus, SCI journals.

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ISBN: 978-1-68576-091-5

MRP Rs. 650/-

PUBLISHER & PRINTER: INSC International Publishers
Pushpagiri Complex, Beside SBI
Housing Board, K.M. Road
Chikkamagaluru Karnataka
Tel.: +91-8861518868
E-mail: publish@iiponline.org
IMPRINT: I I P

About the Authors

Dr. I V Kasi Viswanath, received PhD from Department of Organic Chemistry& FDW, Andhra University, Visakhapatnam in the year 2011. During Doctoral program he worked as a JRF in a DRDO sponsored project under the guidance of Prof. Y. L. N. Murthy. After the completion of doctoral degree, he joined and worked as an Associate Professor in K L University during 2011-2019. Later in the year 2020, he moved to NRI Institute of technology, Vijayawada as a Professor in the Department of Engineering Chemistry (Sciences & Humanities). His main research interests include organic synthesis and nanochemistry. Supervised five doctoral degrees and currently, two research scholars are working with him. He published 47 research publications in various national and international journals with good scientific reputation and also published one e-book in the year 2013. He is currently serving as a potential reviewer for various Scopus and SCI journals.

Dr. Bhagavathula S. Diwakar, received graduation (B.Sc) from ASNM Govt. Degree College, Palakol. He obtained postgraduation (M.Sc) degree and PhD from Department of Organic Chemistry& FDW, Andhra University, Visakhapatnam in the year 2007 and 2013 respectively. During Doctoral program he worked as JRF ina DRDO sponsored project under the guidance of Prof. Y.L.N.Murthy. After completion doctoral degree in 2013 from India in the area of Organic Synthesis, he shifted to do multidisciplinary research in nanotechnology. His interest towards the chemistry of materials proved that he got selected for a project in the international competition in the area of nanotechnology from the Government of Chile. He worked as a Post-Doctoral Research scientist sponsored by FONDECYT (Commission of Science and Technology, Govt. of Chile) postdoctoral project in the Laboratory of Nano-composites under Prof. Koduri Ramam at University of Concepcion, Chile, South America during 2014-2016. Later in the year 2016 he joined as Assistant Professor in the Department of Engineering Chemistry, SRKR Engineering College (A), Bhimavaram. His main research interests include organic synthesis, nanochemistry. Currently one research scholar is working with him. He published 35 research publications in various national and international journals with good scientific reputation. He is currently serving as a potential reviewer for various Scopus, SCI journals.

Dr. Buddeti Govindh, graduated (B. Sc) from Mrs. A V N Degree College, Vizag. He procured masters (M. Sc) degree and Ph.D from Department of Organic Chemistry & FDW, Andhra University, Visakhapatnam in the year 2007 and 2012. During Doctoral program he worked as JRF in a DRDO sponsored project under the guidance of Prof. Y. L. N. Murthy. After completion of doctoral degree in 2012 in the area of Organic Synthesis and Nanomaterils, he worked as Research Associate in DRDO-NSTL project and DRDO-CFEES for developing new fluorescent and fluorine molecules for special applications. In between, he carried out ethnoVet research for couple of years in curing cattle diseases to VisakhDairy company. His interest towards the Organic chemistry & materials proved that he was selected as Co-PI in DRDO-CFEES project in AU in the area of fluorine chemistry from the DRDO authorities. He worked as a Research Associate sponsored by CFEES (DRDO, Govt. of INDIA), project in the Fluorochemistry Laboratory under Prof. Murthy, Andhra University during 2015-2016. Later in the year 2016, he joined as Associate Professor in the Department of S&H, Raghu Institute of Technology (A), Visakhapatnam. His main research interests include organic synthesis, nanochemistry, fluorochemistry. He published 39 research publications in various national and international journals with good scientific reputation. He is currently serving as a potential reviewer for various Scopus, SCI journals.

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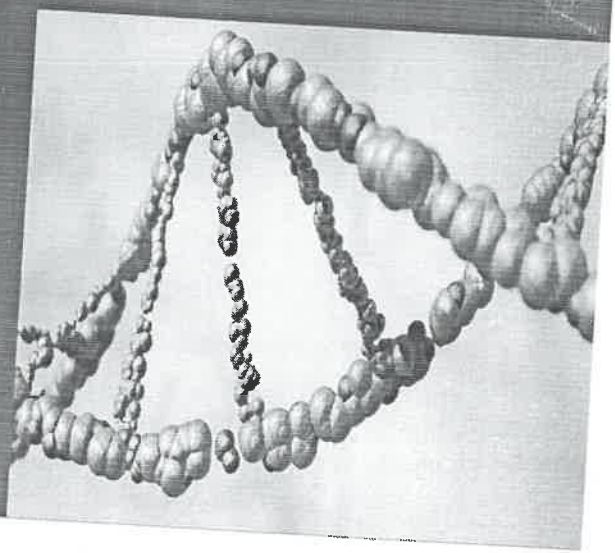

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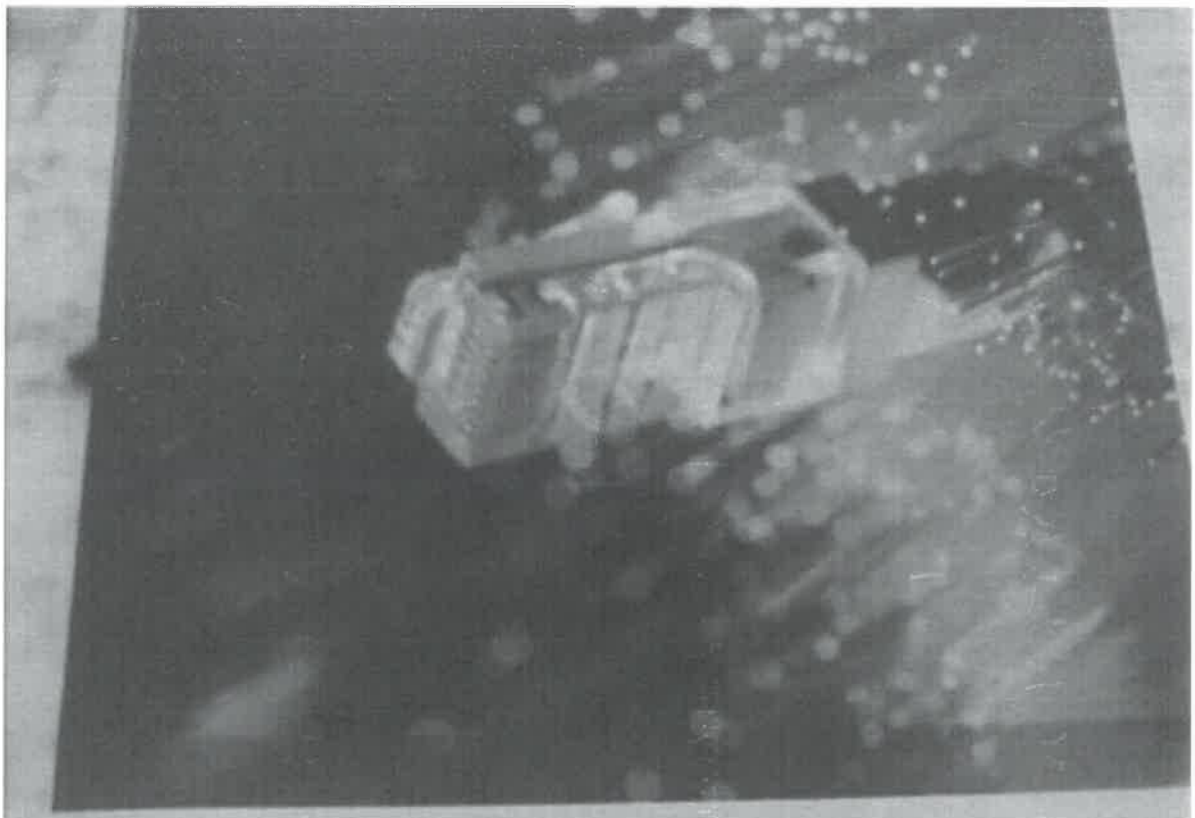

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Title of the Book: **FIBER OPTIC COMMUNICATION**

Edition: First - 2022
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ISBN: 978-93-94002-70-8
MRP: Rs. 550/-

PUBLISHER & PRINTER: Scientific International Publishing House
Contact: +917019991025
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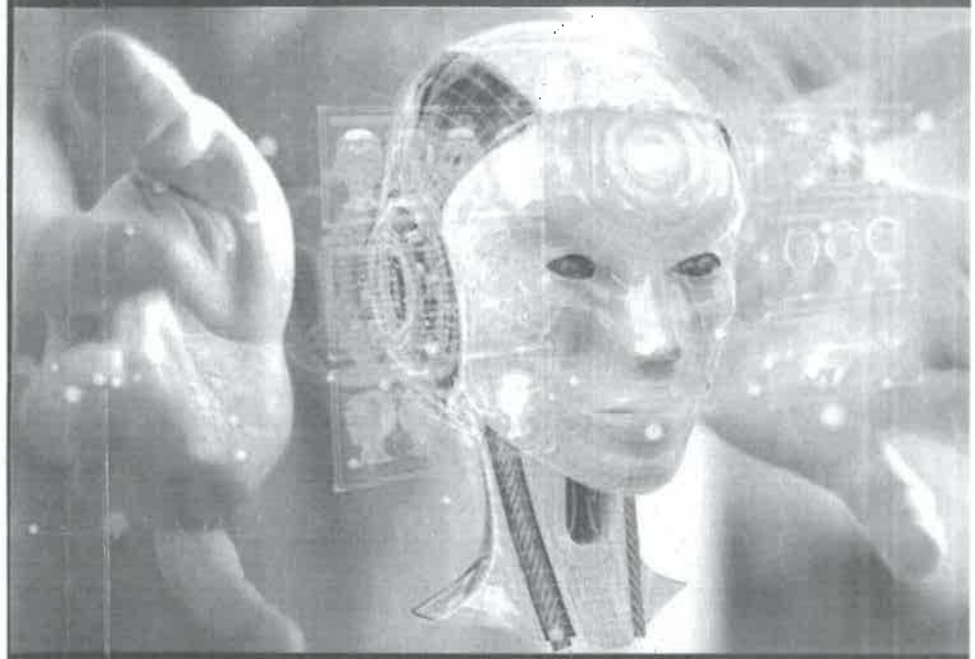

Authors

K Nitalaksheswara Rao | Dr. Satyanarayana. Mummana

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Title: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING - A PRACTITIONER'S APPROACH

Author's Name: K Nitalaksheswara Rao
Dr. Satyanarayana. Mummana
CH V Murali Krishna
Alabazar Ramesh

Published by: Shanlax Publications,
Vasantha Nagar, Madurai – 625003,
Tamil Nadu, India

Publisher's Address: 61, 66 T.P.K. Main Road,
Vasantha Nagar, Madurai – 625003,
Tamil Nadu, India

Printer's Details: Shanlax Press, 66 T.P.K. Main Road,
Vasantha Nagar, Madurai – 625003,
Tamil Nadu, India

Edition Details (I,II,III): I

ISBN: 978-93-94899-57-5

Month & Year: June, 2022

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Dr. Satyanarayana. Mummana
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Pages: 235

Price: ₹350/-

ISBN

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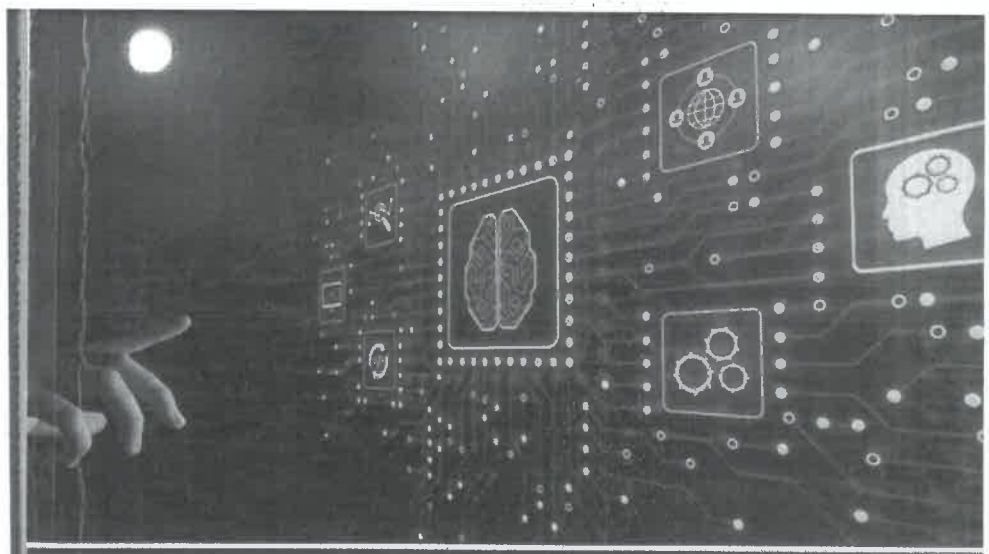

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Title:	Machine Vision and Intelligence: Neural Networks and Deep Learning from scratch
Editor's Name:	Dr. K Nitalaksheswara Rao Muvva Praveen Kumar CH .V. Murali Krishna Dr. D. Uma Devi
Published by:	Forschung Publications
Publisher's Address:	Forschung Publications, Madurai – 625 011.
Printer's Details:	Shanlax Press, 66 T.P.K. Main Road, Vasantha Nagar, Madurai – 625003, Tamil Nadu, India
Edition Details (I,II,III):	I
ISBN:	978-93-91772-08-6
Month & Year:	August, 2022
Copyright @	Dr. K Nitalaksheswara Rao Muvva Praveen Kumar CH .V. Murali Krishna Dr. D. Uma Devi
Pages:	254
Price:	₹350/-

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Printed at: see last page
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Mr K. Nitalaksheswara Rao is pursuing Ph.D. in Computer Science and Systems Engineering at Andhra University Visakhapatnam India. He is the topper of the school at SSC level and batch topper at M.Tech level. He has more than 10 years of teaching and 5 years of research experience. He published 6 patents intellectual property of India.

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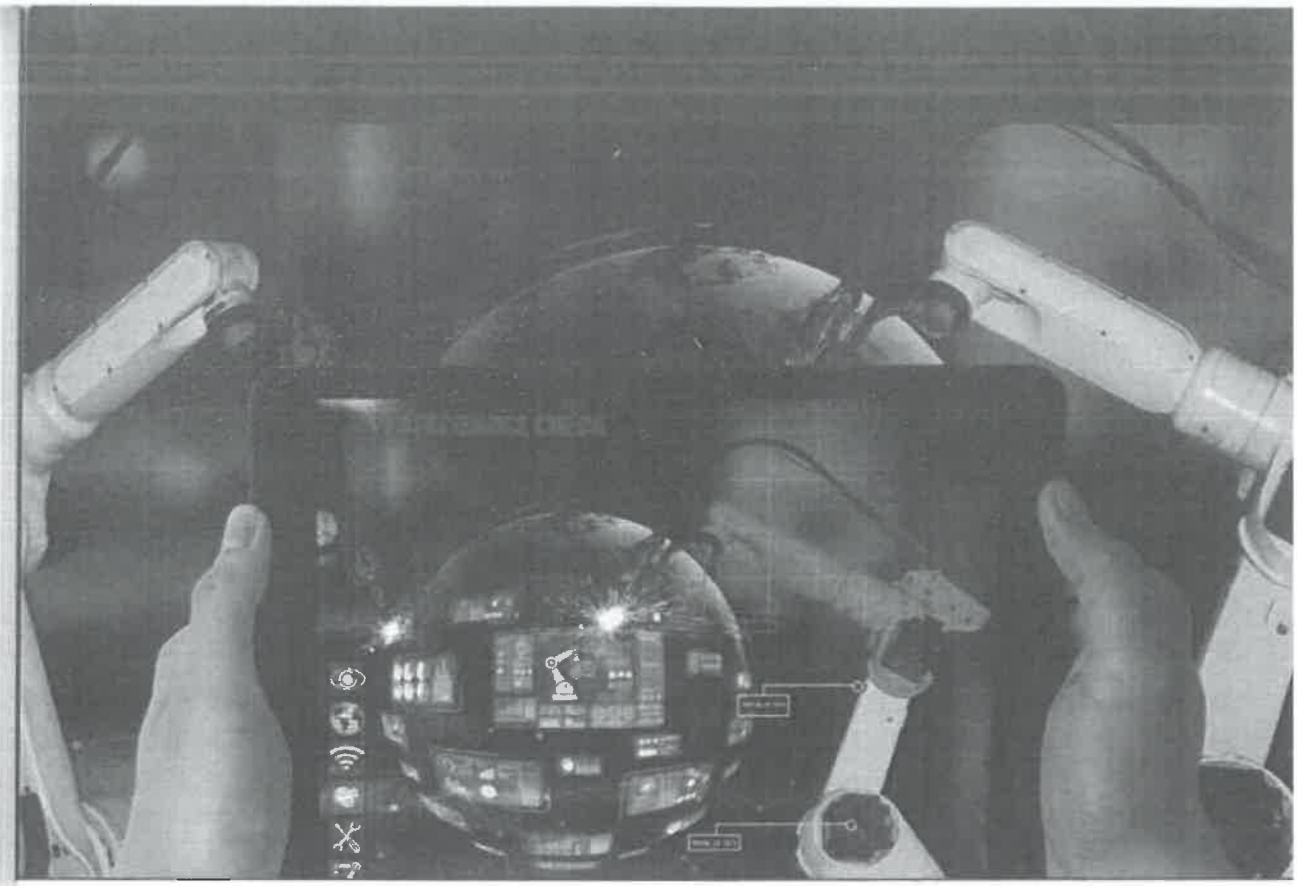

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Printed at: see last page
ISBN: 978-620-4-71768-5

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Author is working as an Associate Professor in Department of Computer Science and Engineering at Sreenivasa Institute of Technology and Management Studies, Chittoor, Andhrapradesh, India. She has completed PhD in Computer Science and Engineering at Jawaharlal Nehru Technological Univ., Hyderabad. She holds more than 25 international publications.

9 786204 717685

Print ISBN: 978-93-91215-40-8, eBook ISBN: 978-93-91215-41-5

Chapter 5

A Real - time Optimizing Water Utilization Technique for Exactitude Agriculture Using WSN and GSM Module in Indian Agricultural Sectors

Prathyusha. Kuncha[1]* and M. Chaitanya Suman[2]

DOI: 10.9734/bpi/tpmcs/v11/8178D

ABSTRACT

India is the agriculture based country. Our ancient people completely depended on the agricultural harvesting. Agricultural sector is playing vital role in Indian economy, in which irrigation mechanism is of key concern. Our work aim is to control the wastage of water in the field by using the drip irrigation and also to provide exact controlling of field by atomizing the agricultural environment by using the components and building the necessary hardware. Irrigation by help of freshwater resources in agricultural areas has a crucial importance. Because of highly increasing demand for freshwater, optimal usage of water resources has been provided with greater extent by automation technology and its apparatus such as drip irrigation, sensors and remote control. The humidity and temperature of plants are precisely monitored and controlled more efficiently, which is a real time feedback control system. By using drip irrigation the water will be maintained at the constant level i.e. the water will reach the roots by going drop by drop. Irrigation system controls valves by using automated controller to turn ON & OFF. This allows the farmer to apply the right amount of water at the right time, regardless of the availability of the labor to turn valves or motor ON & OFF. This reduces runoff over watering saturated soils avoid irrigating at the wrong time of the day. It improves crop performances and help in time saving in all the aspects.

For the precisely monitoring and controlling of the agriculture filed, different types of sensors were used. To implement the proposed system ARM LPC2148 Microcontroller is used. In this work an ARM LPC2148 Microcontroller based drip irrigation mechanism is proposed, which is a real time feedback control system for monitoring and controlling all the activities of drip irrigation system more efficiently.

The information is given on user request in form of SMS. Eg. GSM modem can be controlled by standard set of AT (Attention) commands. These commands can be used to control majority of the functions of GSM modem. GSM serves as an important part as it is responsible for controlling the irrigation on field and sends them to the receiver through coded signals. GSM operates through SMS's and is the link between ARM processor and centralized unit. GSM technology is used to inform the end user about the exact field condition. The drip method of irrigation has been found to have a significant impact on resources saving, cost of cultivation, yield of crops and farm profitability.

Keywords: ARM LPC 2148 microcontroller; GSM; temperature; humidity; soil moisture; leaf sensor; PH; level; phase sensor.

1 Introduction

Agricultural irrigation is highly important in crop production everywhere in the world. Our ancient people completely depended on the agricultural harvesting. In Turkey, 75% of the current fresh water is consumed in the agricultural irrigation. Therefore, efficient water management plays an important role in the irrigated agricultural cropping systems. Drip irrigation systems can be classified as Traditional Drip Irrigation system, Subsurface Drip Irrigation (SDI) and low cost alternative systems. In this work the design of a Microcontroller

[1]Department of E.C.E, NRI Institute of Technology, Pothavarappadu, Agiripalli(M), Vijayawada, A.P, India.
[2]Department of E.C.E, Vignan's Nirula Institute of Technology and Science for Women, Guntur, A.P, India.
**Corresponding author: E-mail: prathyushakuncha@gmail.com;*

3 Methodology

In general, the sensors will give analog output but our processor will accept only the digital data. So we have to connect all the sensors to the ADC channel pins which are in-built to the processor. The total circuit arrangement is shown in the below figure (i.e. Fig. 1). LCD is for the field display purpose. In the circuit the GSM module will contains a Subscriber Identity Module (SIM) user can communicate with this SIM-Number. When the particular command activated or given by the user, immediately the corresponding sensor will activates and reads the present reading and immediately sends results (Text message) to the end user mobile and displays in the LCD panel in the field. Immediately user will take the necessary action if required. This facilitates the end user to response immediately further to avoid or to provide the proper supply of water for crop irrigation. Here we are using total seven sensors to monitor the field condition. Those are Temperature, Humidity, Soil moisture, Leaf sensor, PH sensor, Water Level sensor, Phase sensor. All these devices are connected to the ARM processor.

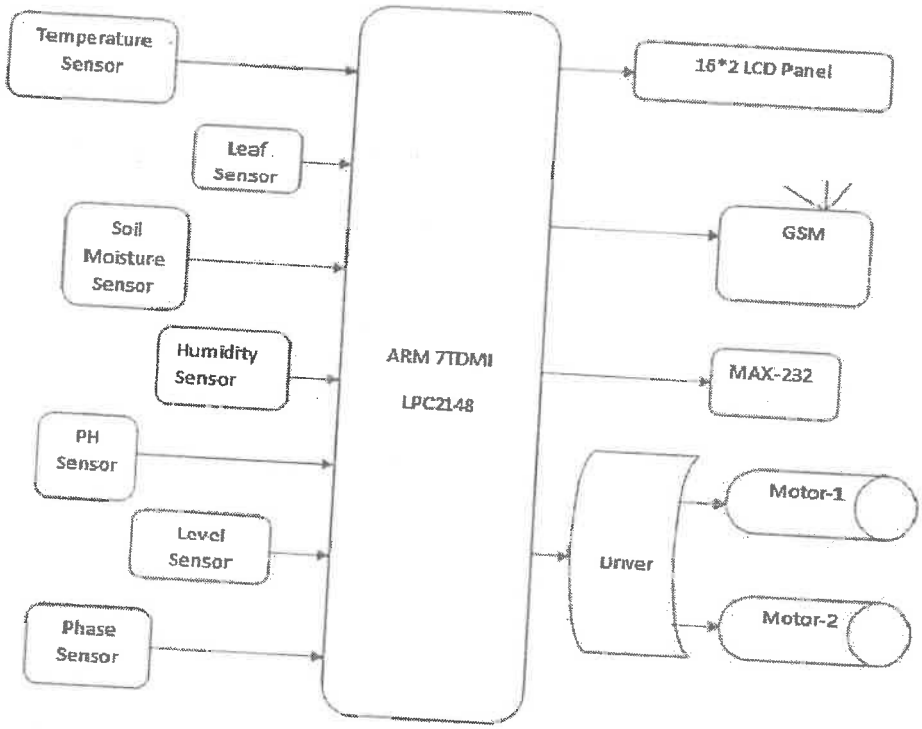

Fig. 1. Block Diagram of Real – Time Irrigation System

Here other important devices are AC motors. For soil module and level sensing applications we are using motors. One motor is used to store water and another is for releasing the stored water into the soil. The circuit arrangement is given below and the detailed pin connections are shown below in the Fig. 3. These will monitor the field and gives the accurate results to the user. Here the Leaf sensor, PH, Soil, Level sensors are used to monitor weather leafs are healthy or not

- To monitor weather leafs are healthy or not.
- The PH sensor is used to monitor the soil condition, weather the soil having harmful acidic nature or normal base nature. If acidic nature is present means we have to dilute the content and neutralize it or we will provide the necessary fertilizer.
- In case of soil moisture, we will check weather soil is dry or wet. If it is dry means, this condition is very harmful to plants. So immediately an SMS will be sending to the farmer to release the water into the soil and make it wet. For this we will use the level sensor and phase sensor will be very useful.
- Temperature and humidity are useful in the case of monitoring the weather conditions.

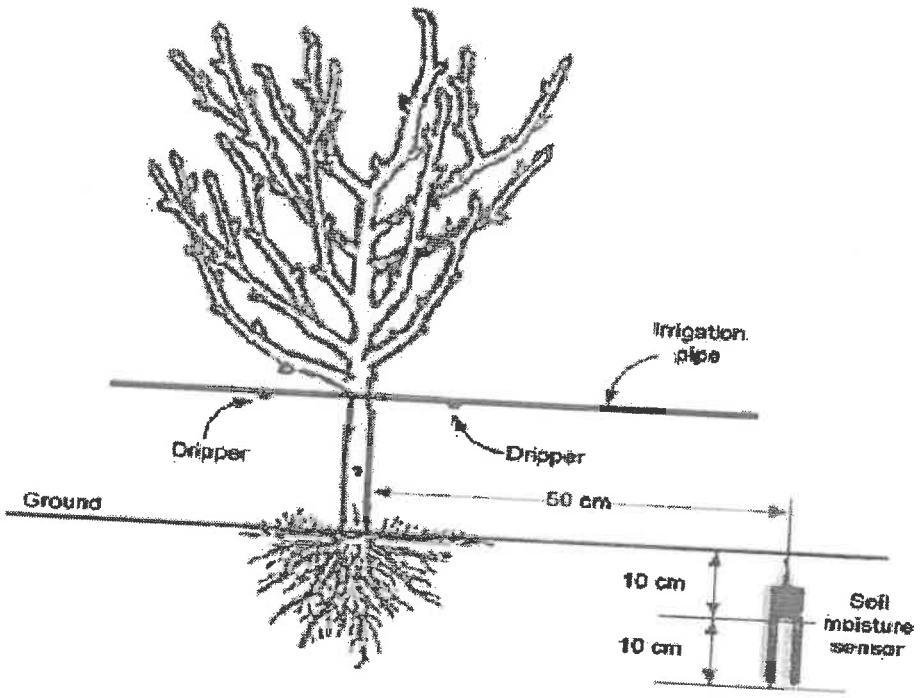

Fig. 3. Drip irrigation [7]

A wetted profile developed in the plant's root zone is as shown in Figure above. Its shape depends on soil characteristics. Drip irrigation saves water because only the plant's root zone receives moisture. Little water is lost to deep percolation if the proper amount is applied. Drip irrigation is popular because it can increase yields and decrease both water requirements and labor.

5 Circuit Diagram of Real – Time Irrigation System

Our circuit diagram for the real –time irrigation system in agriculture is given below with different types of sensors. The arrangement consists of all the devices and it includes pin connections. Each pin connection is shown clearly in the below figure. All the sensors are connected to data, we need to give these outputs to ADC-pins.

6 Operation of Real-time Atomation of Indian Agricultural System

Before going to the operation of the circuit, first we have to give the necessary power supply to all the components. The designed components need 5v supply to work whereas the arm processors need 3.3v supply. So we are giving 3.3v from the LM317. This is the device can provide 3.3v to the processor. For remaining devices will get supply from our power supply circuit will give 5v output. MCU-based home wireless control centre is used along with one WSN centre node module and several data collecting nodes, GSM module, GSM network and mobile phone. The WSN data collecting node modules are connected with different types of sensors.

When the components are activated, all the components will read and gives the output signal to the controller, when the user want to get the information then user should have to send a message from his mobile and immediately corresponding readings will send short message to the users through the GSM module and GSM network immediately. Here we use only GSM for prototype development.

8 Future Enhancements

By developing a Smart Wireless Sensor and by using upcoming techniques a farmer can increase his profit by solving different problems that are faced by the farmer in his routine life. And also to involve ARM – Controller with a video capturing by using an MMS facility about the crop position and at the same time sending video to the farmer. Internet of Things (IoT) is a network of sensors and connectivity to enable application like agriculture optimum irrigation with efficiency of feedback control method. Irrigation can also be done using solar tracking systems. Apart from ARM LPC2148, PIC Microcontroller, Arduino, Raspberry Pi microcontrollers can be used.

Competing Interests

Authors have declared that no competing interests exist.

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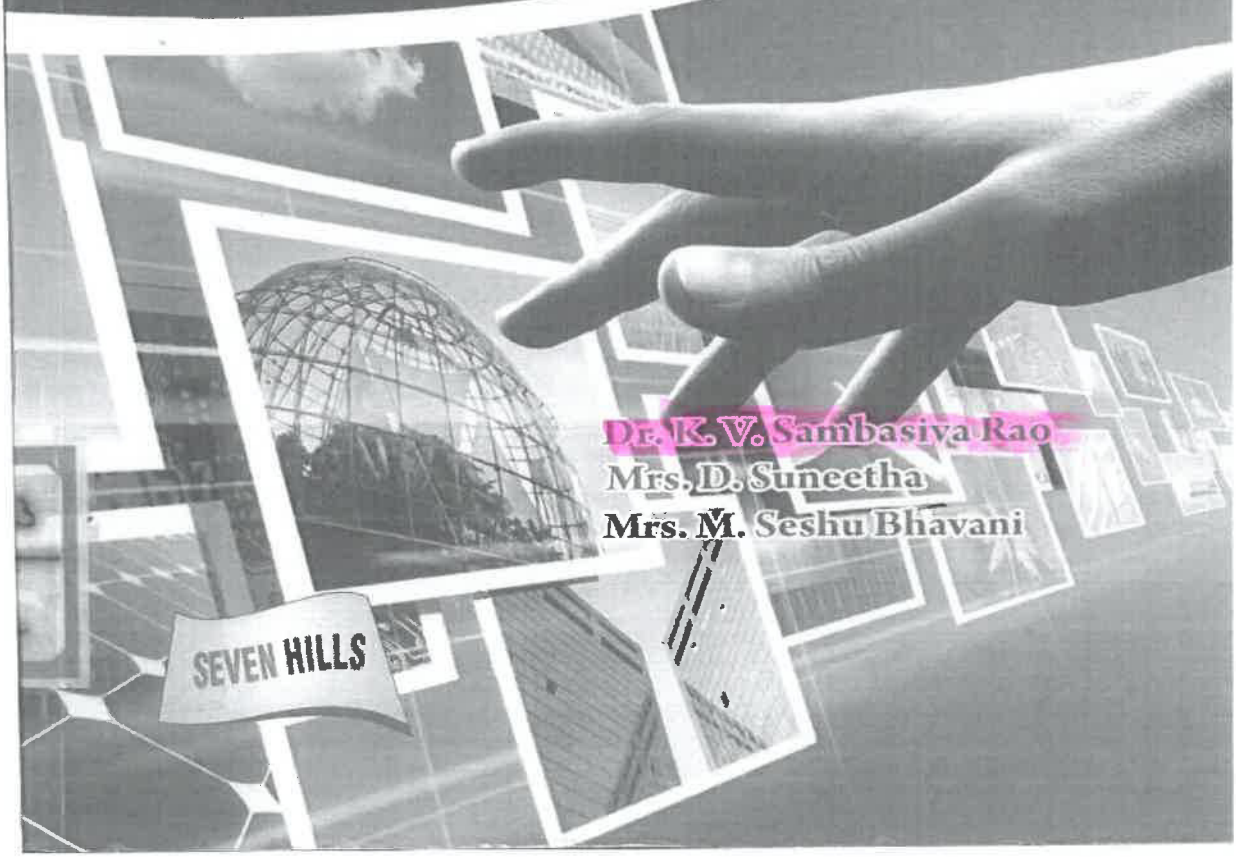

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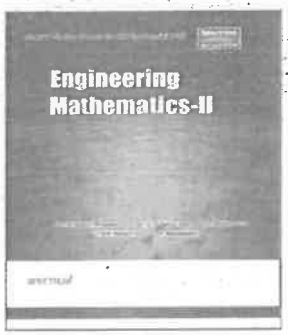

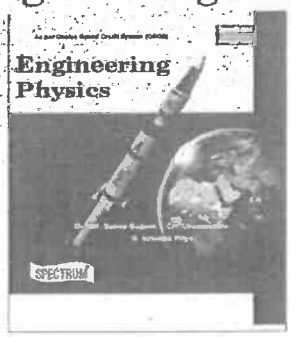

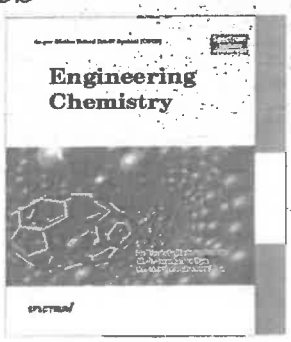

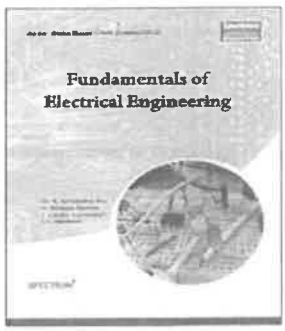

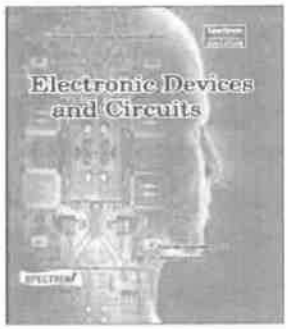

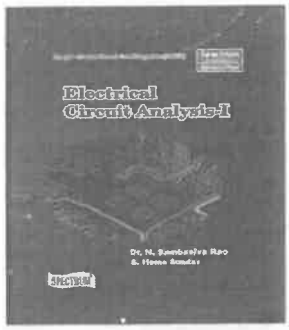

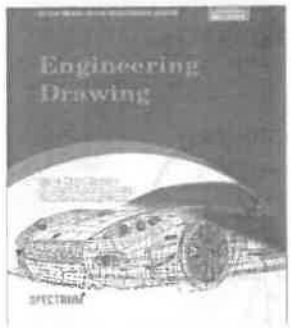

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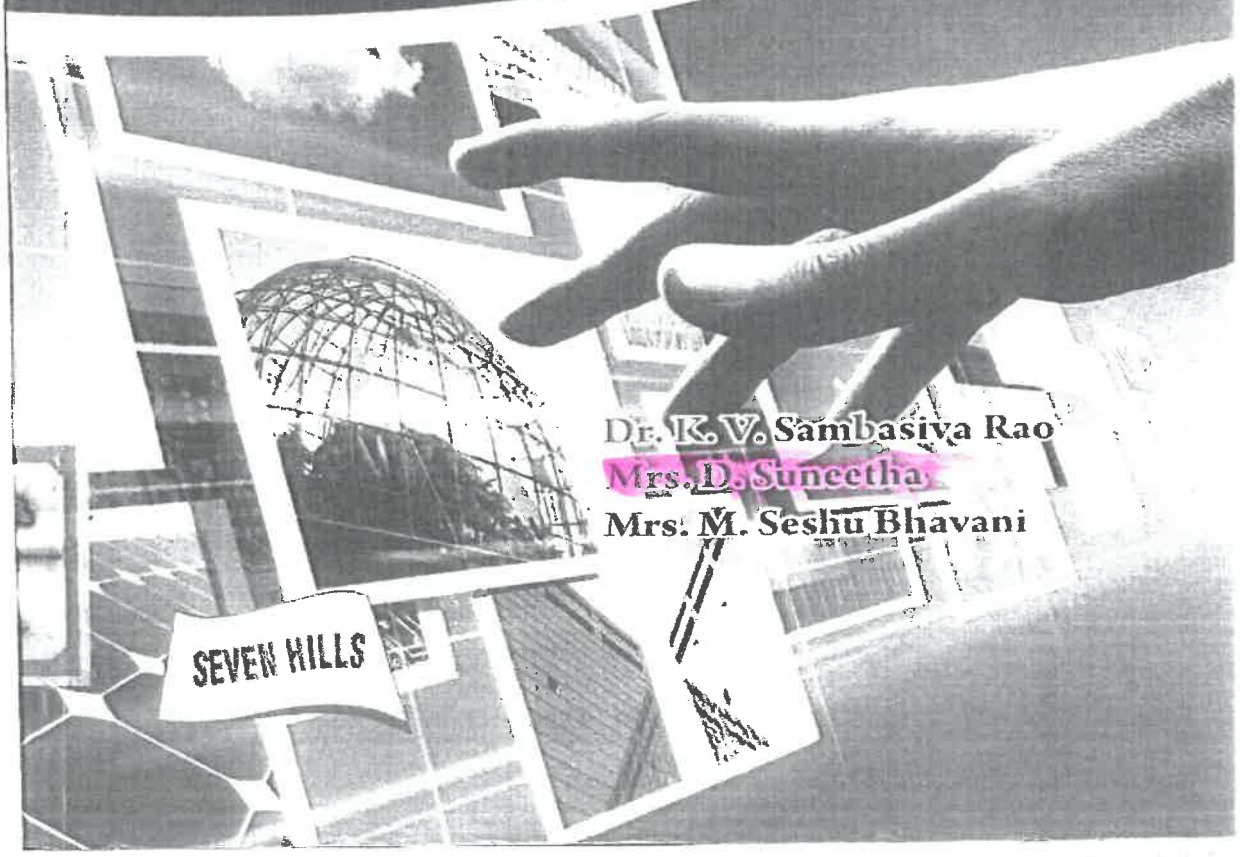

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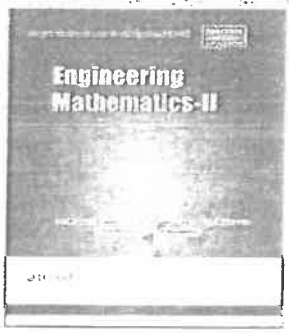

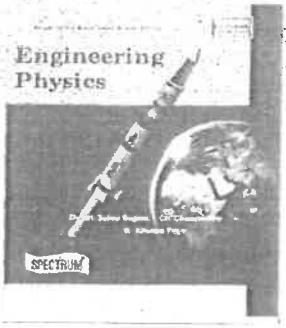

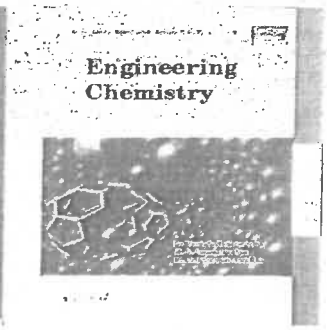

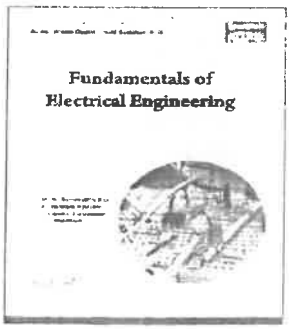

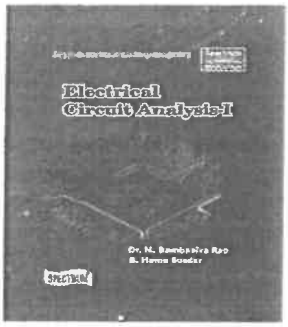

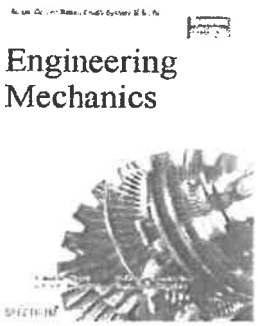

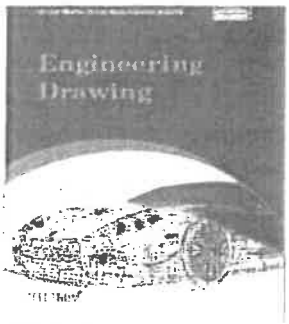

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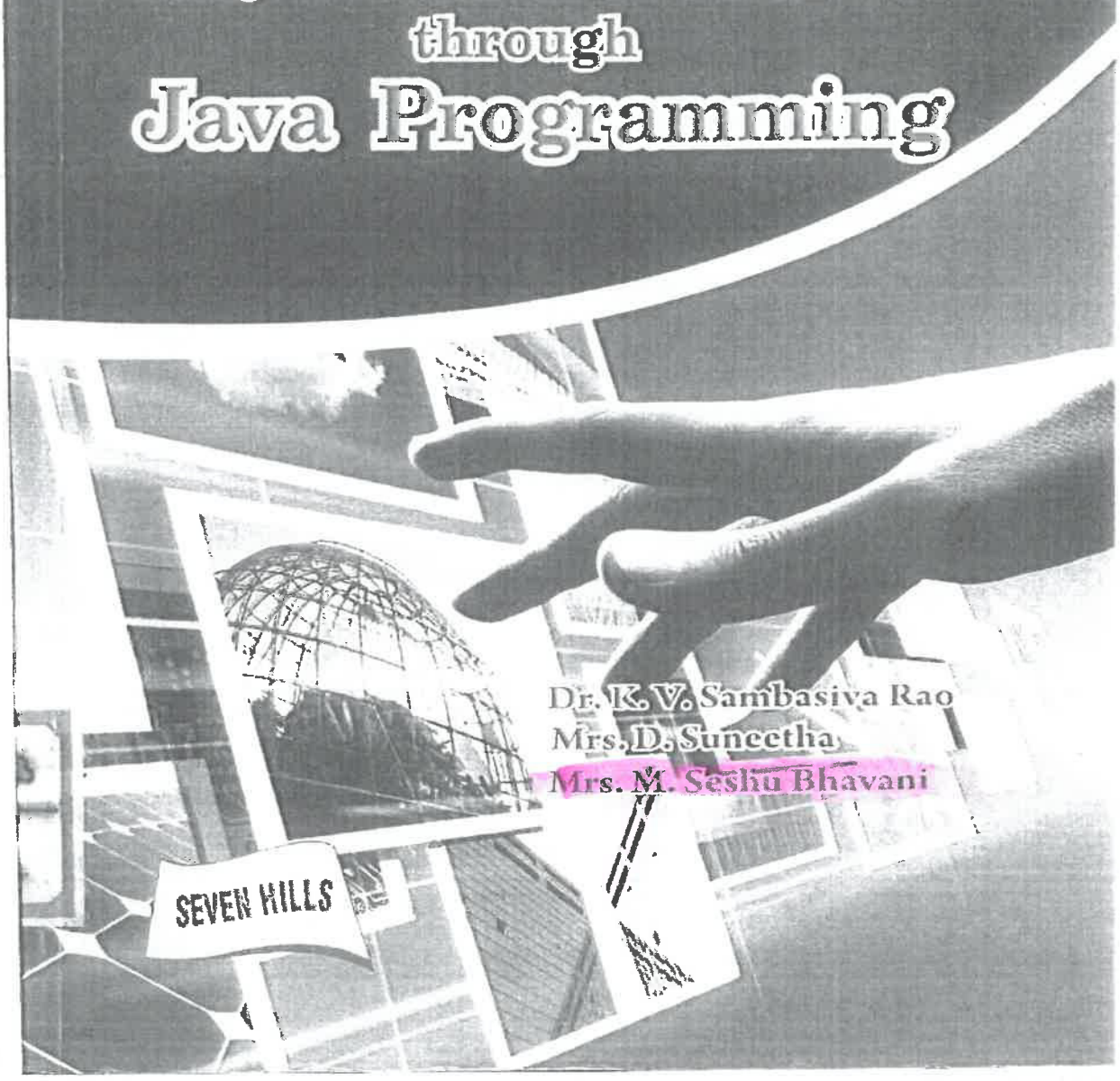

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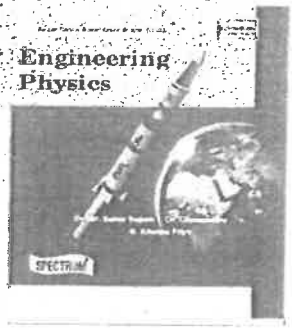

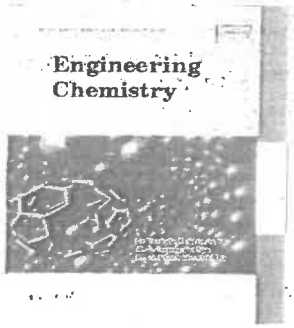

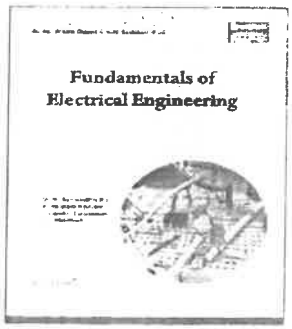

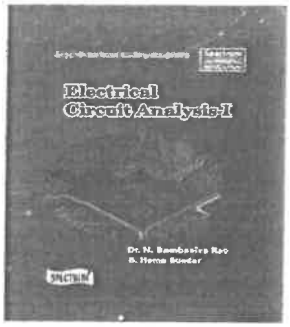

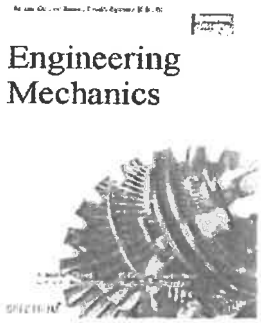

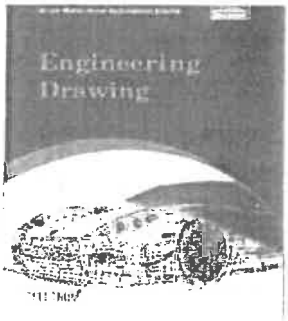

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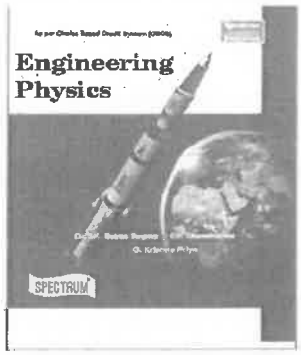

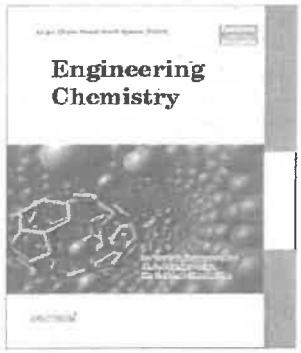

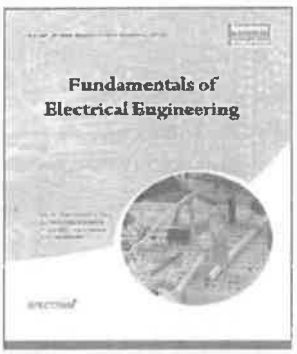

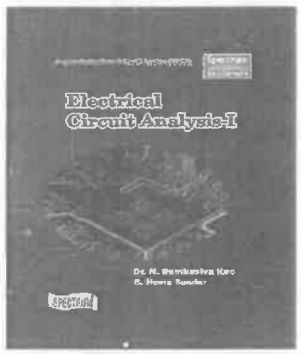

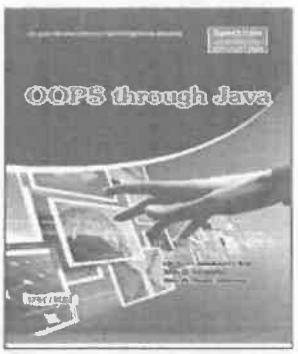

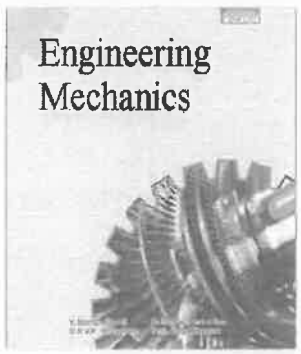

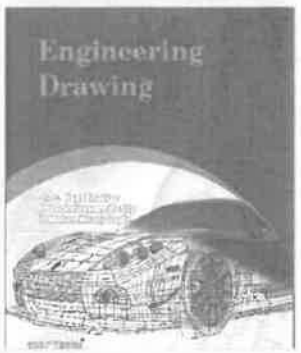

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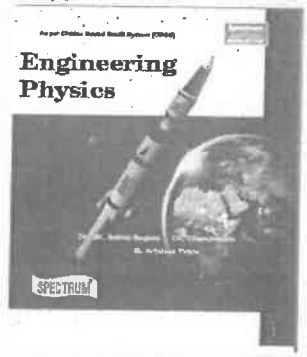

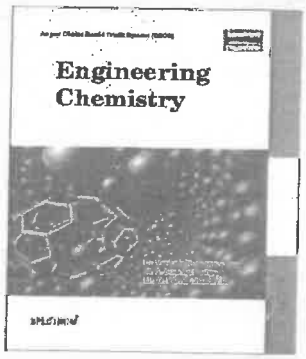

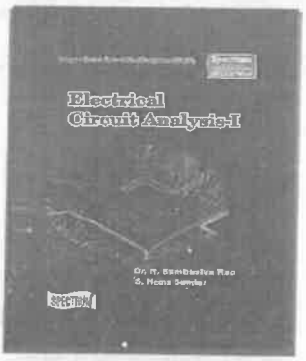

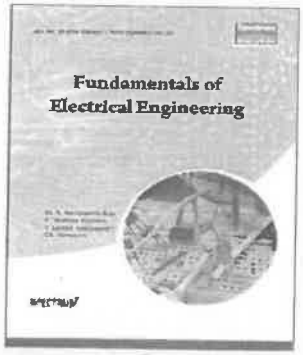

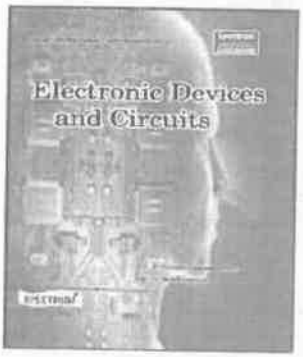

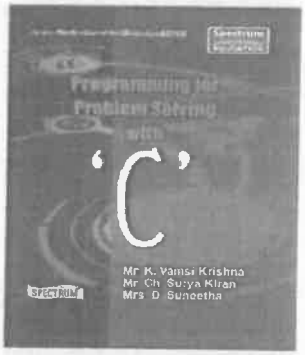

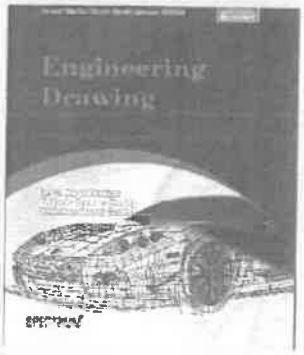

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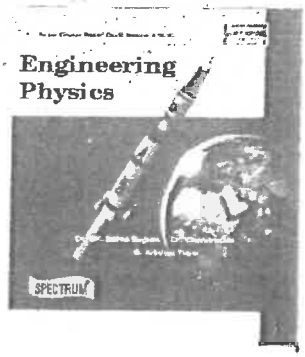

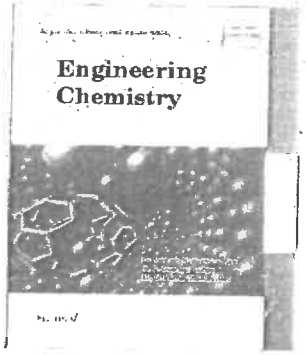

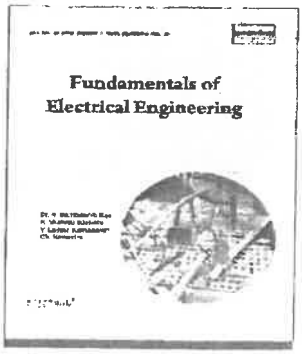

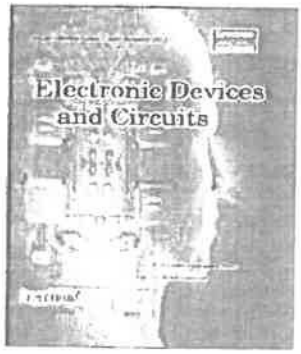

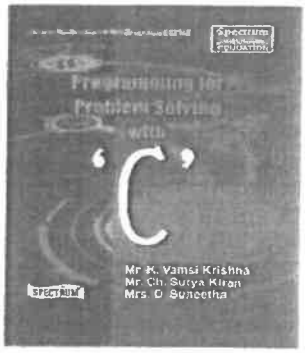

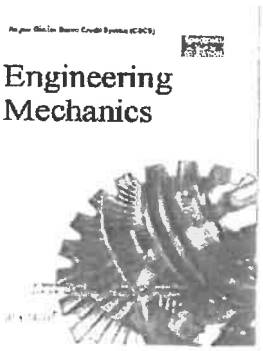

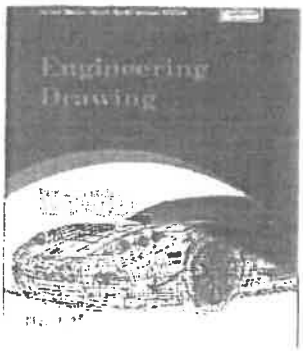

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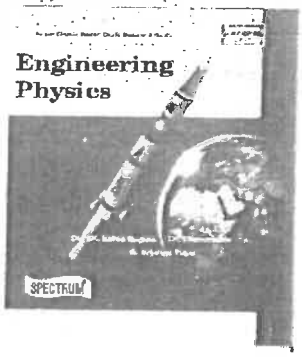

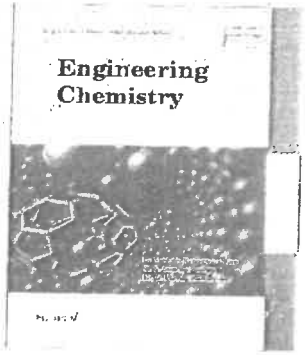

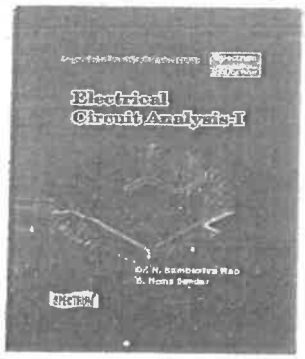

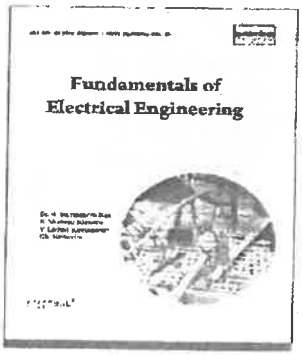

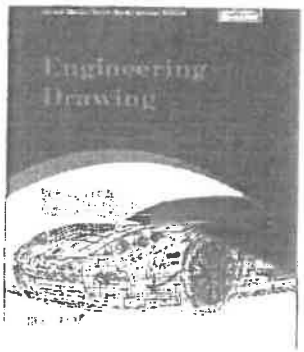

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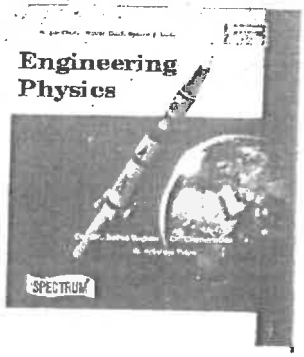

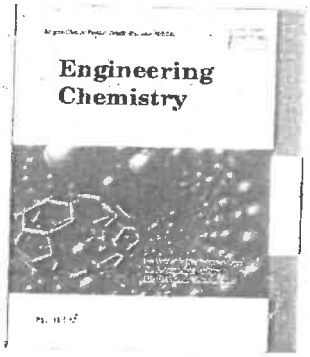

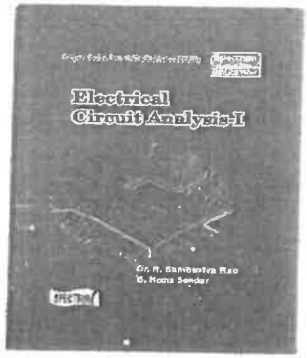

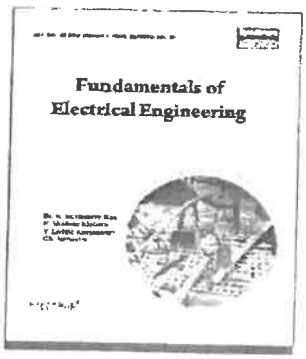

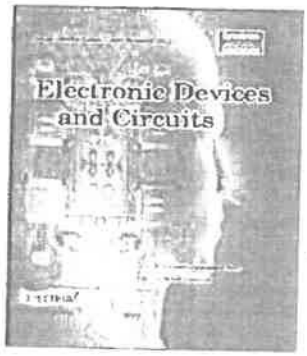

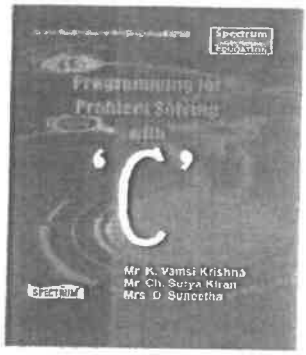

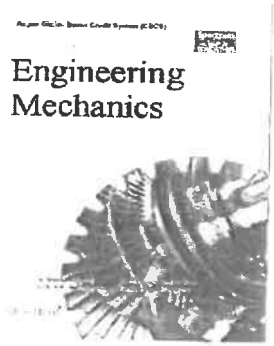

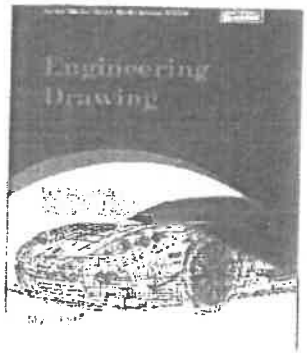

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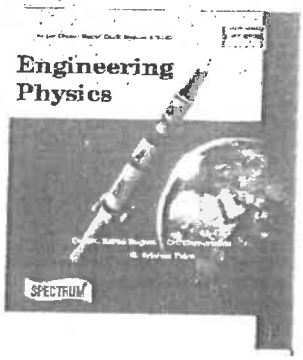

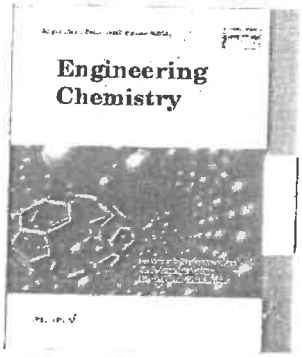

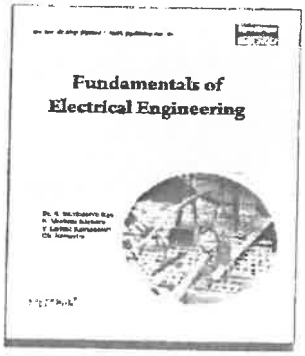

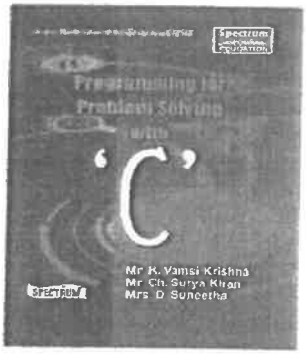

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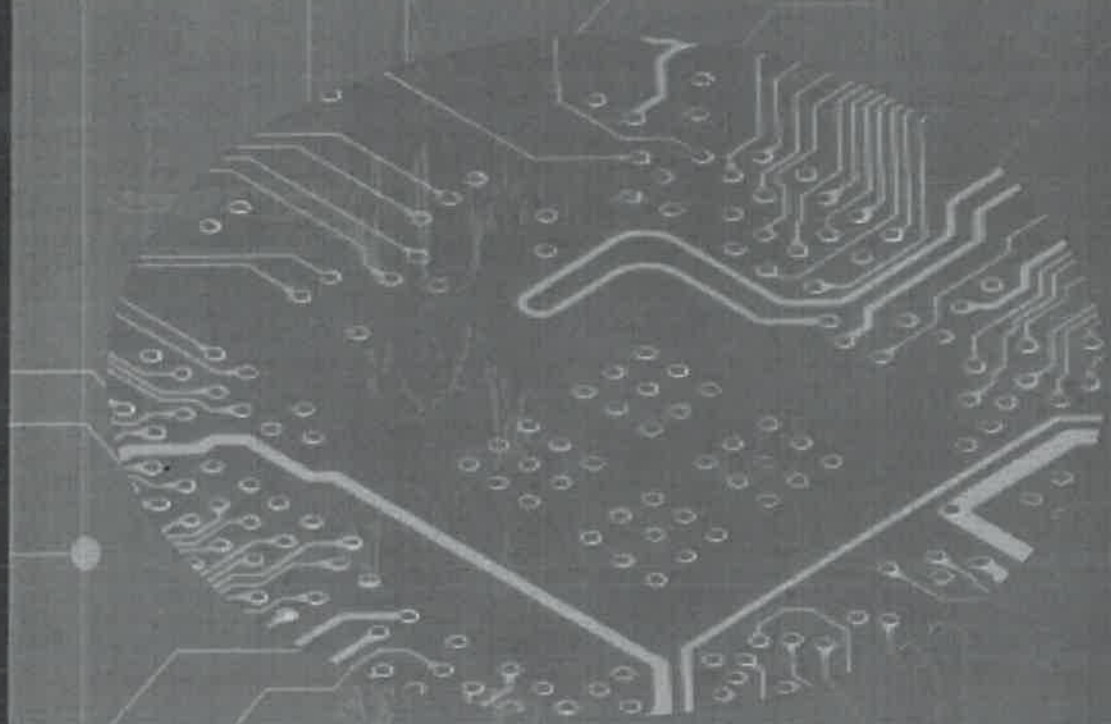

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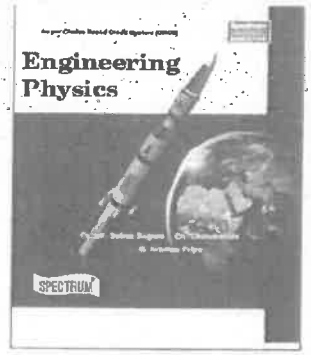

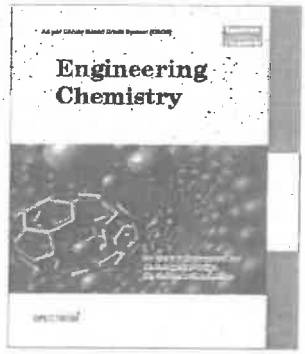

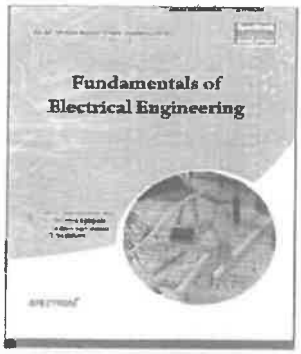

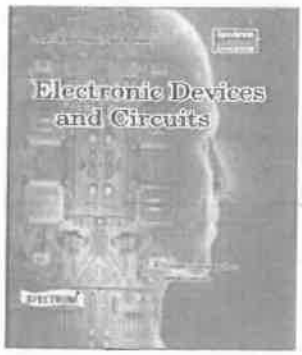

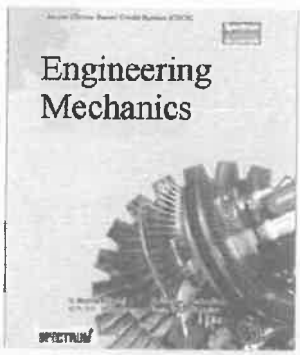

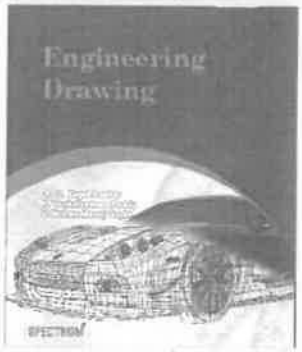

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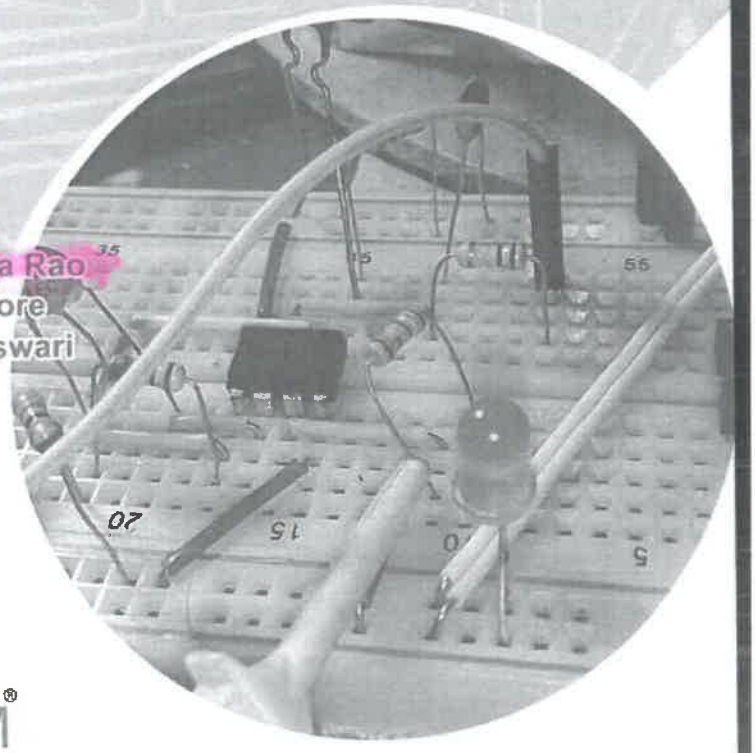

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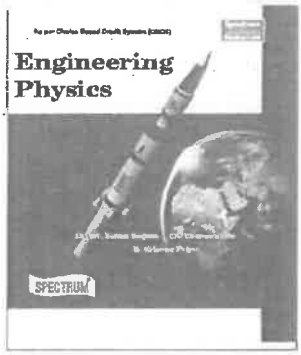

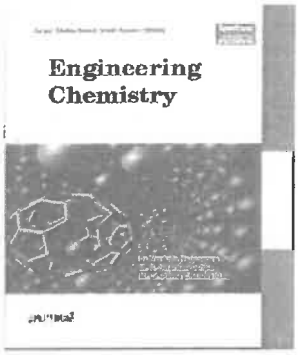

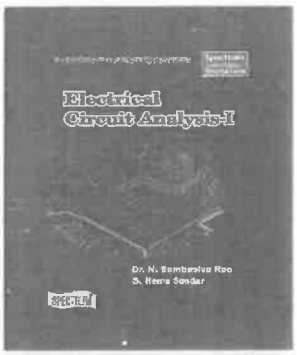

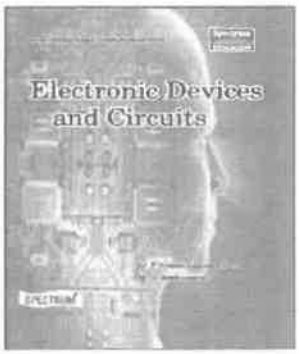

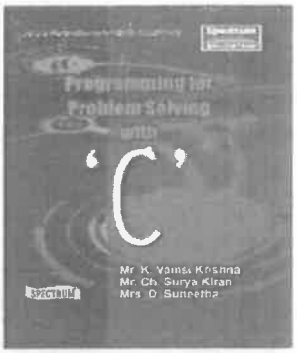

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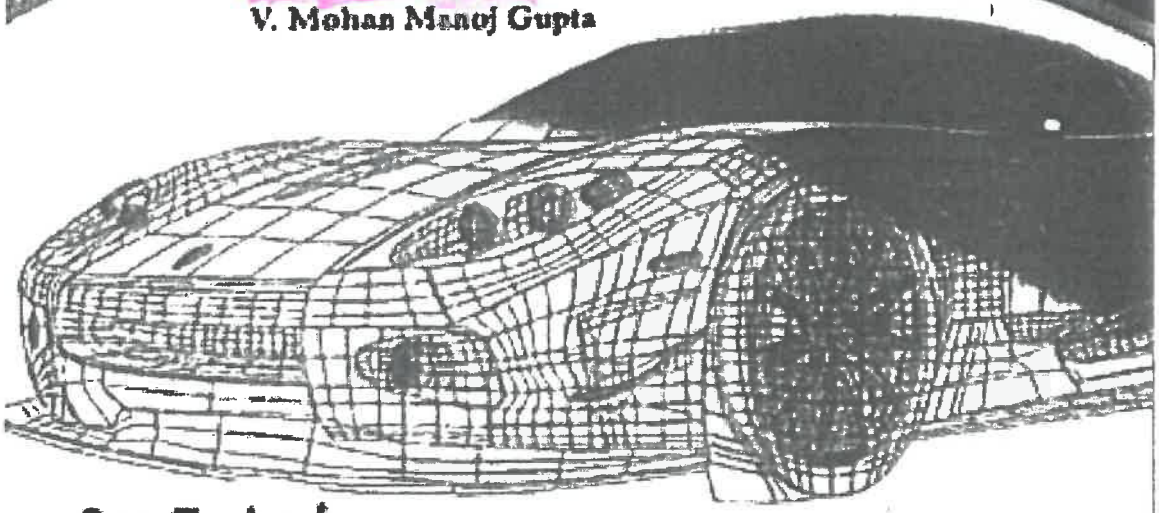

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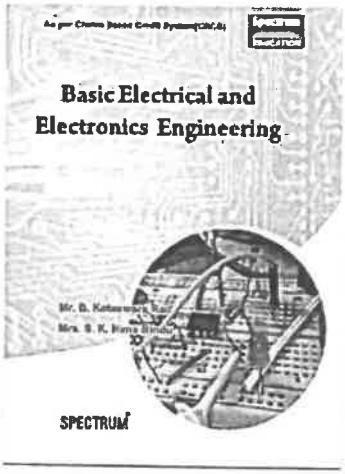

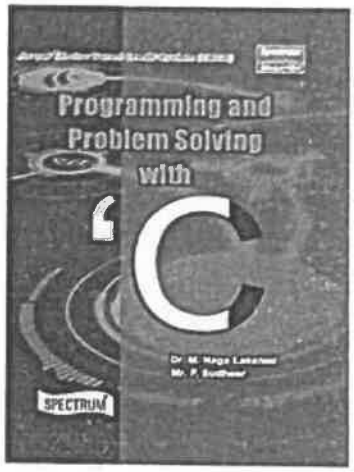

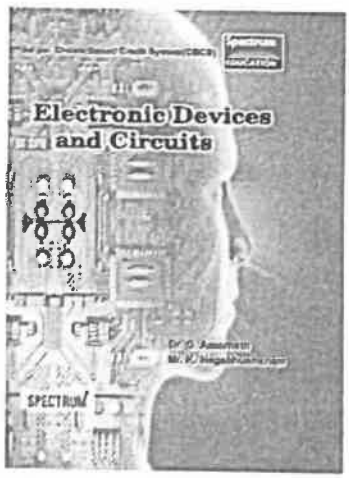

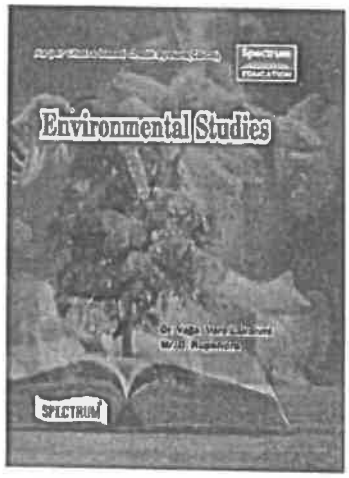

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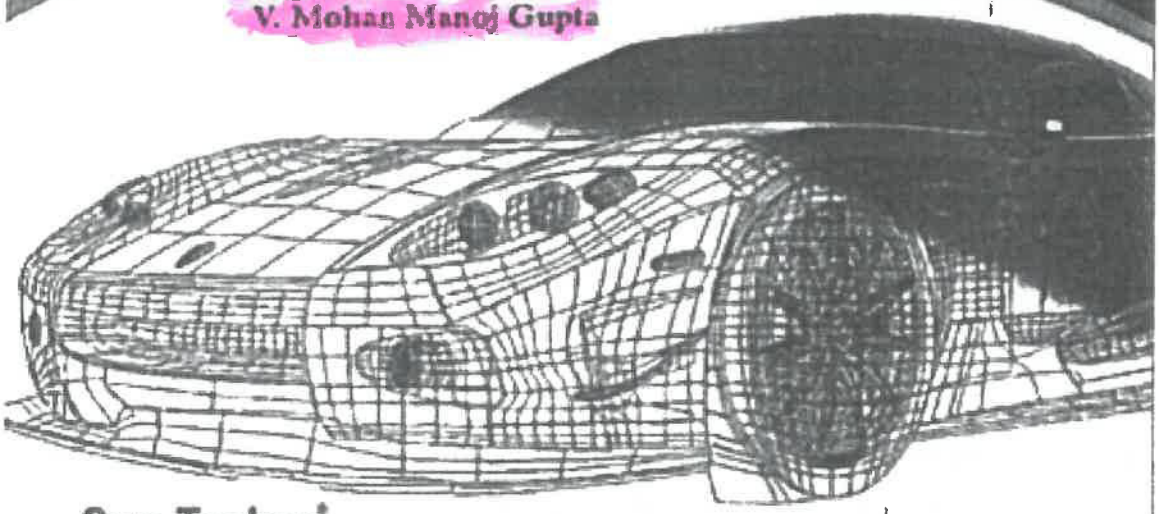

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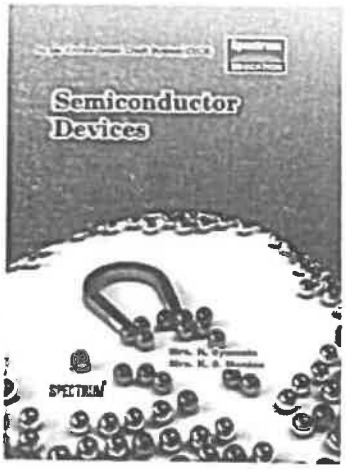

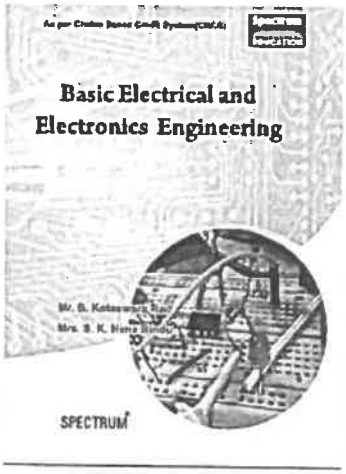

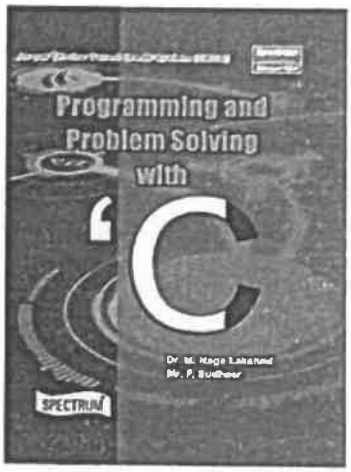

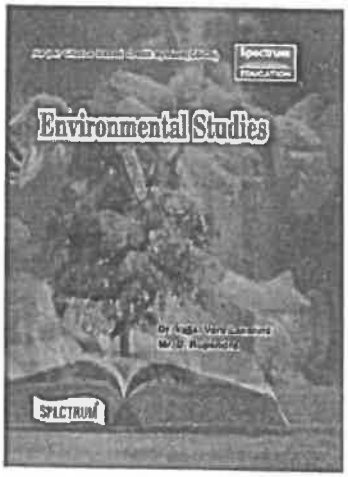

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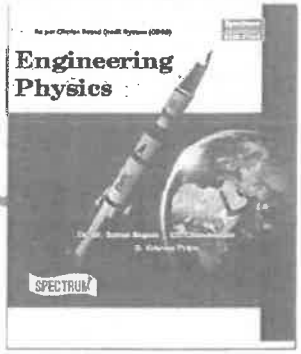

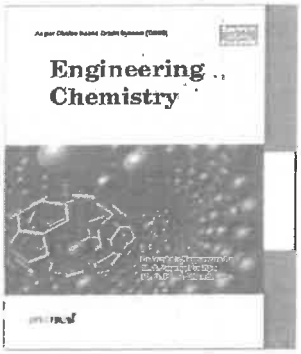

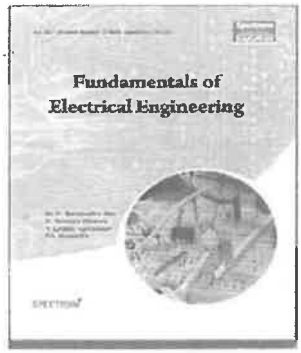

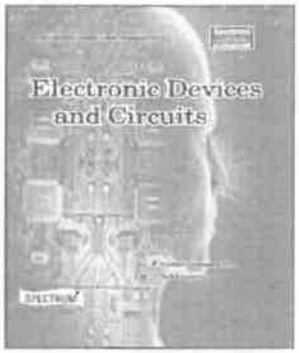

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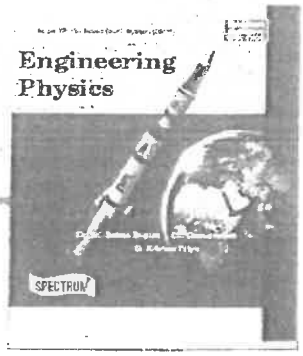

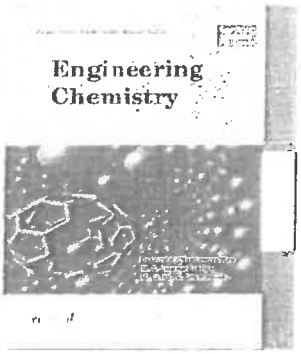

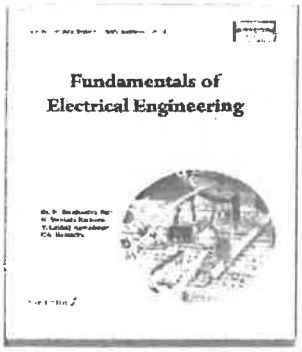

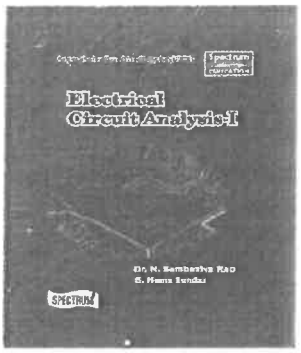

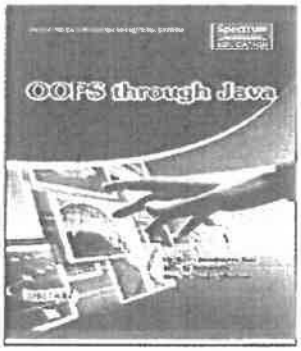

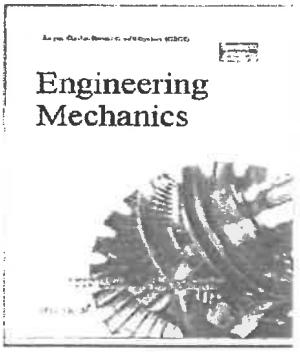

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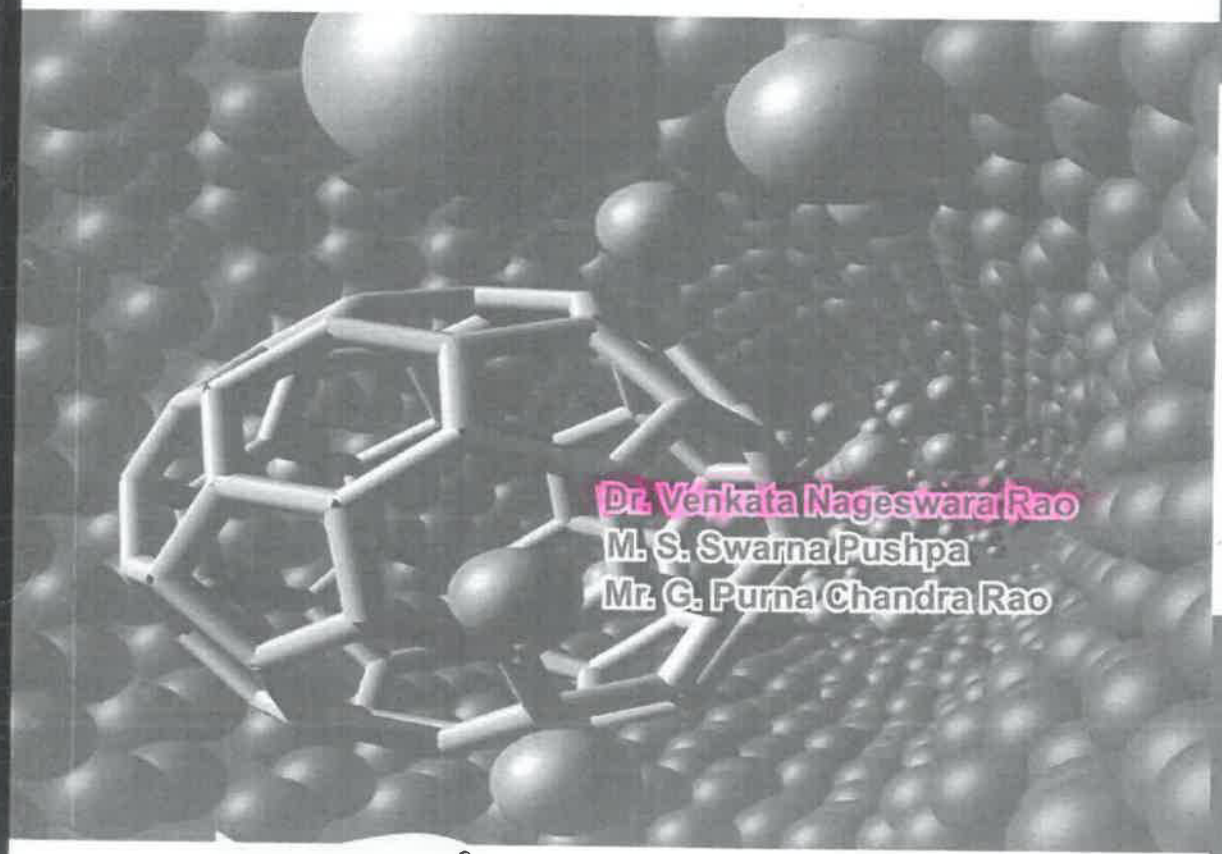

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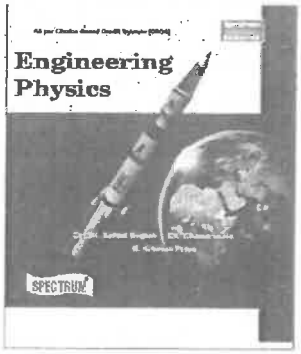

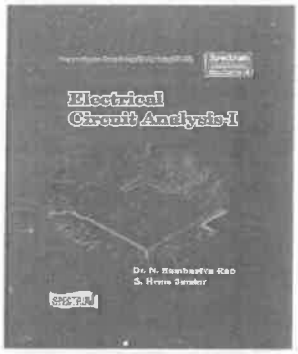

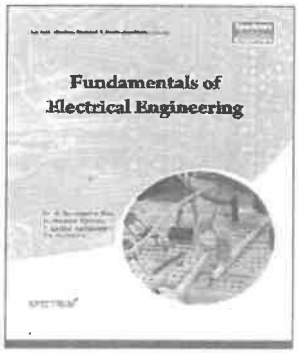

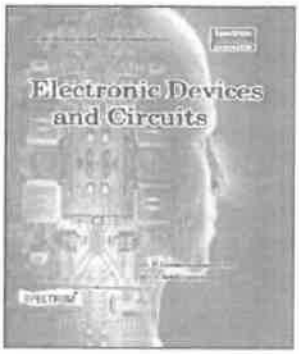

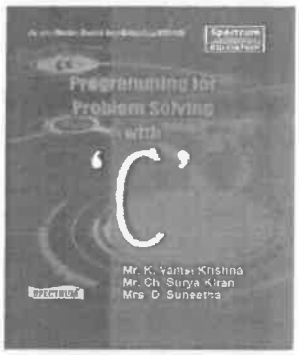

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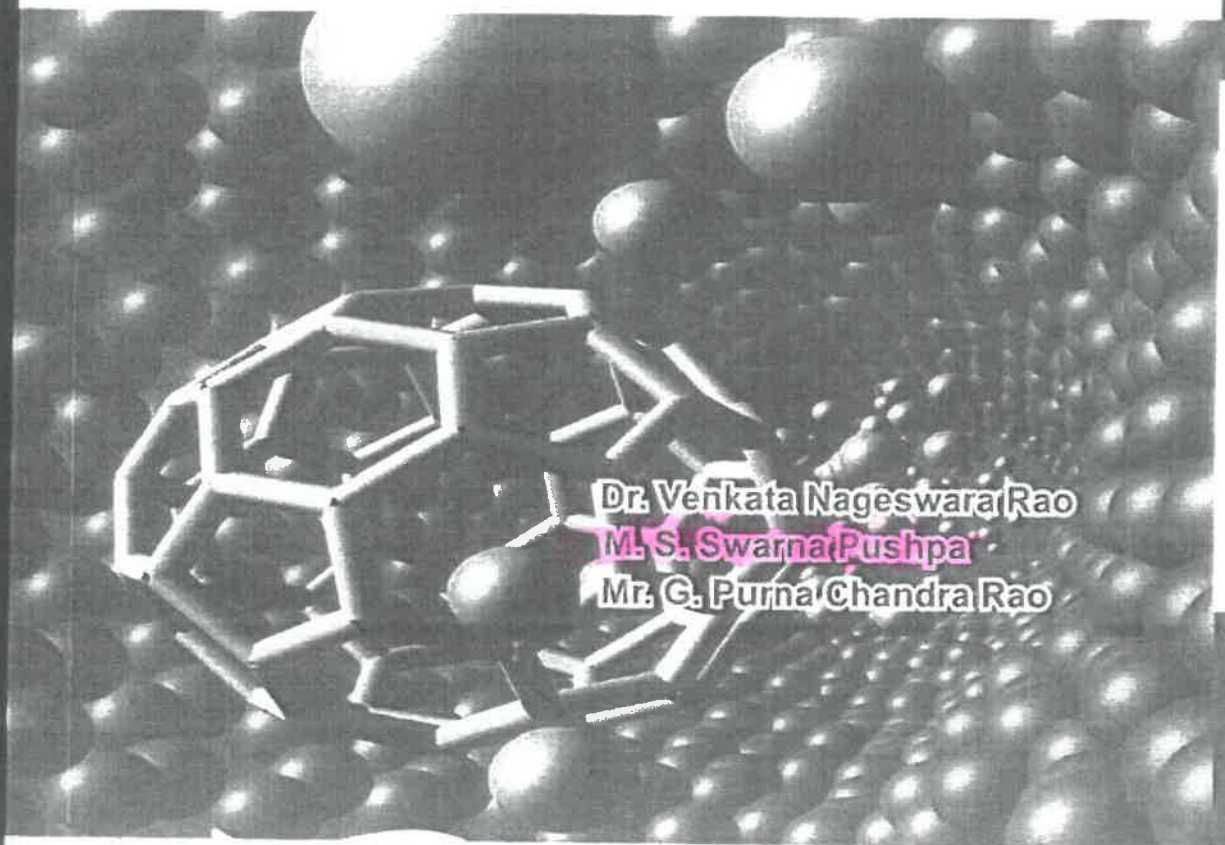

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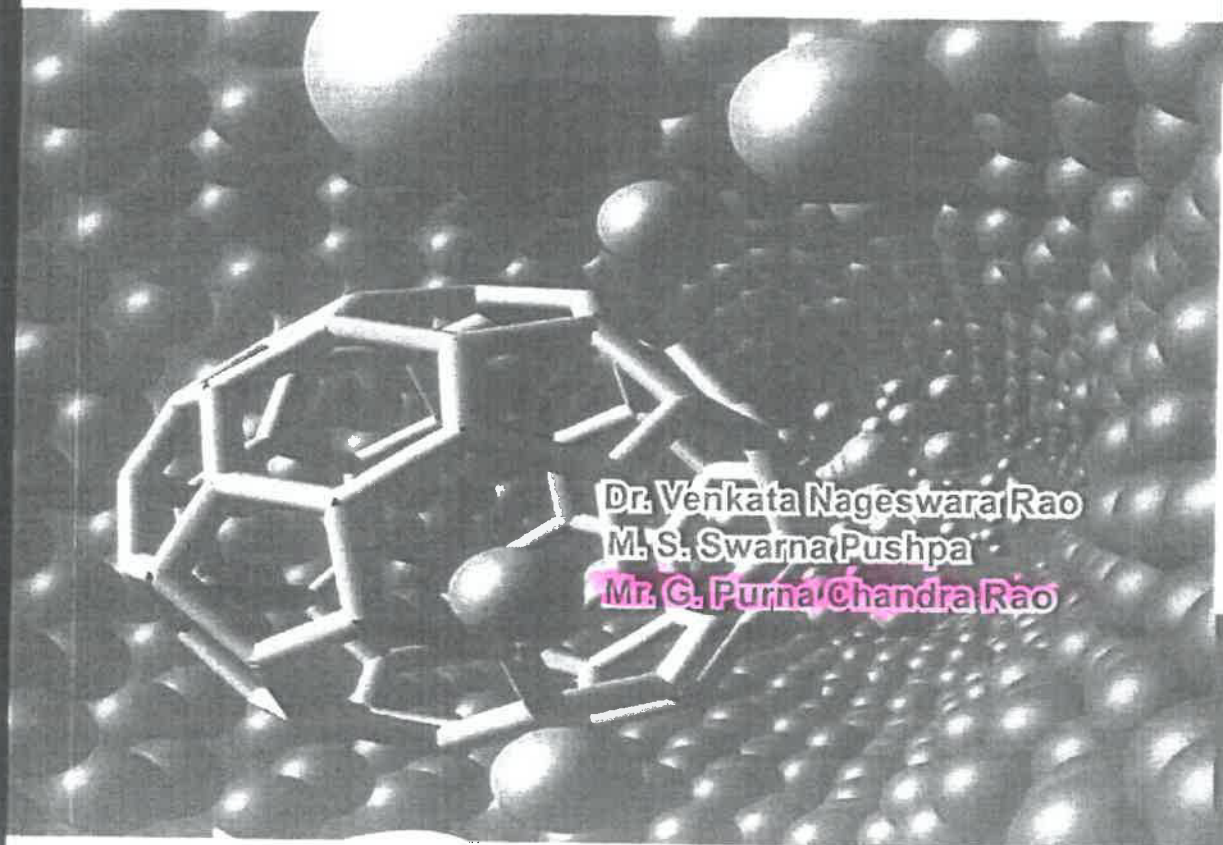

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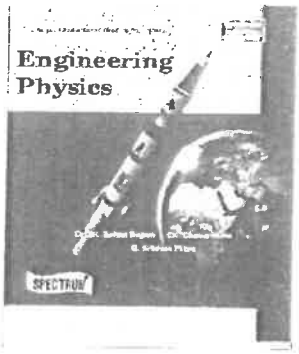

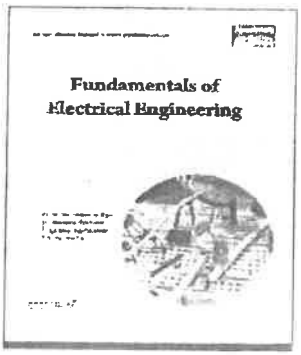

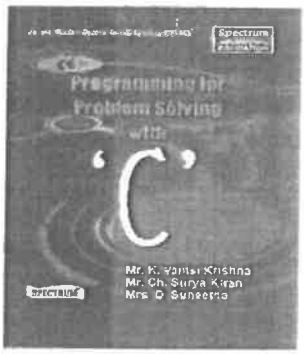

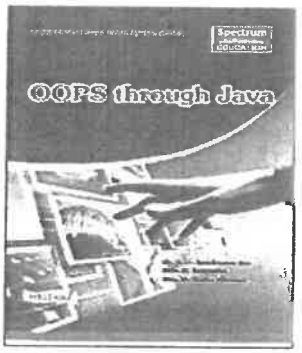

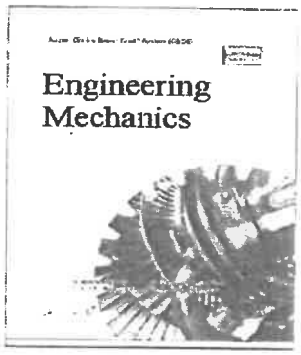

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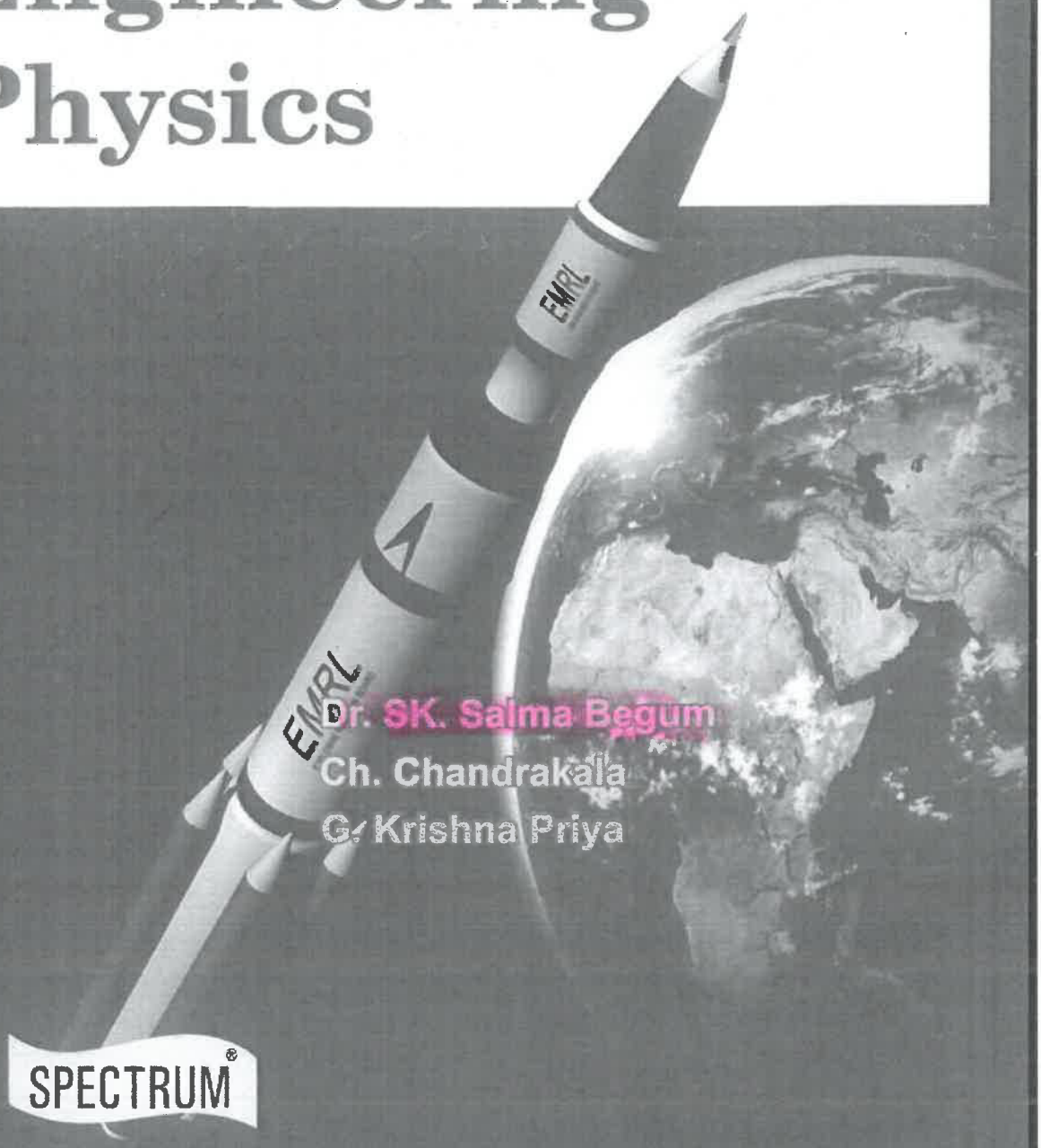

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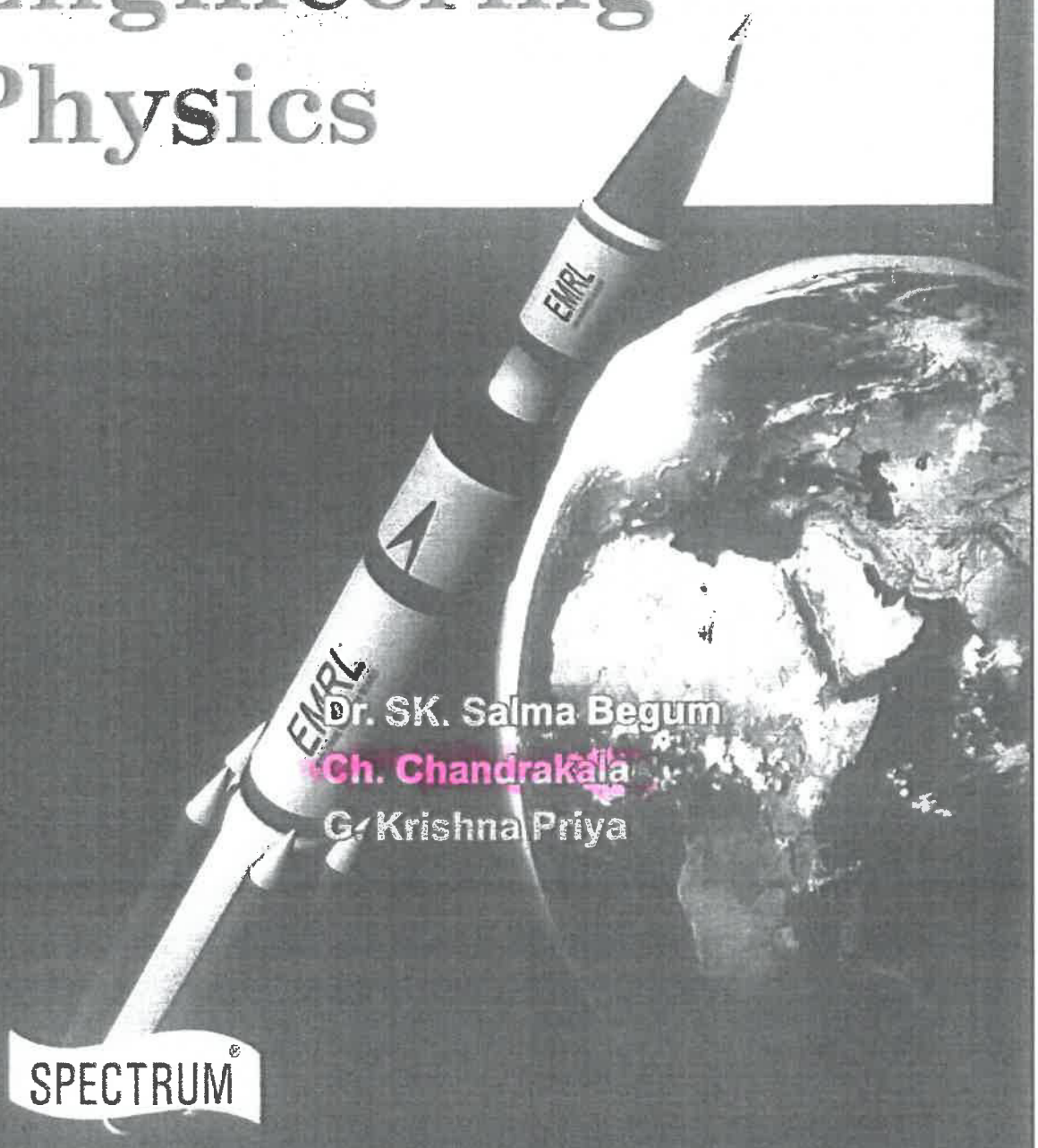

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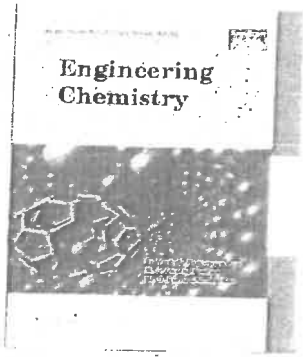

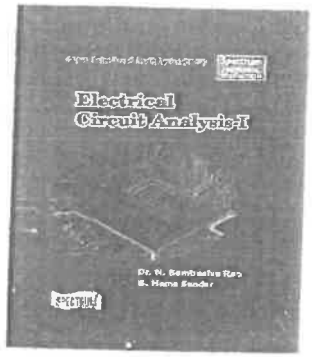

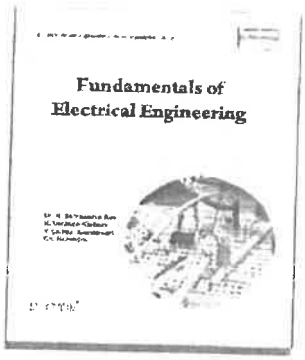

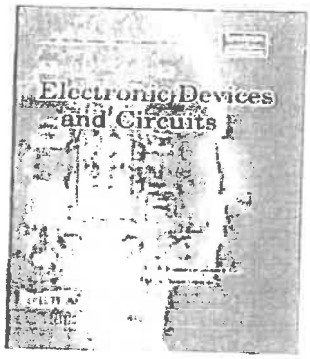

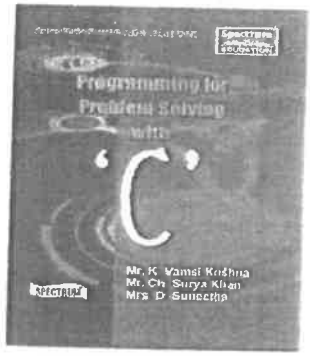

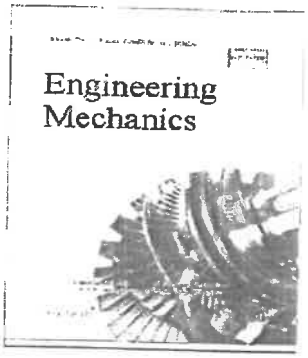

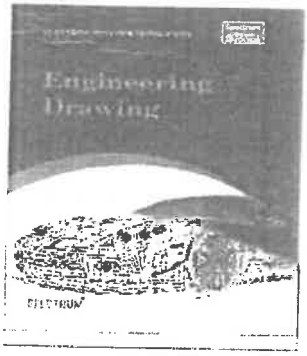

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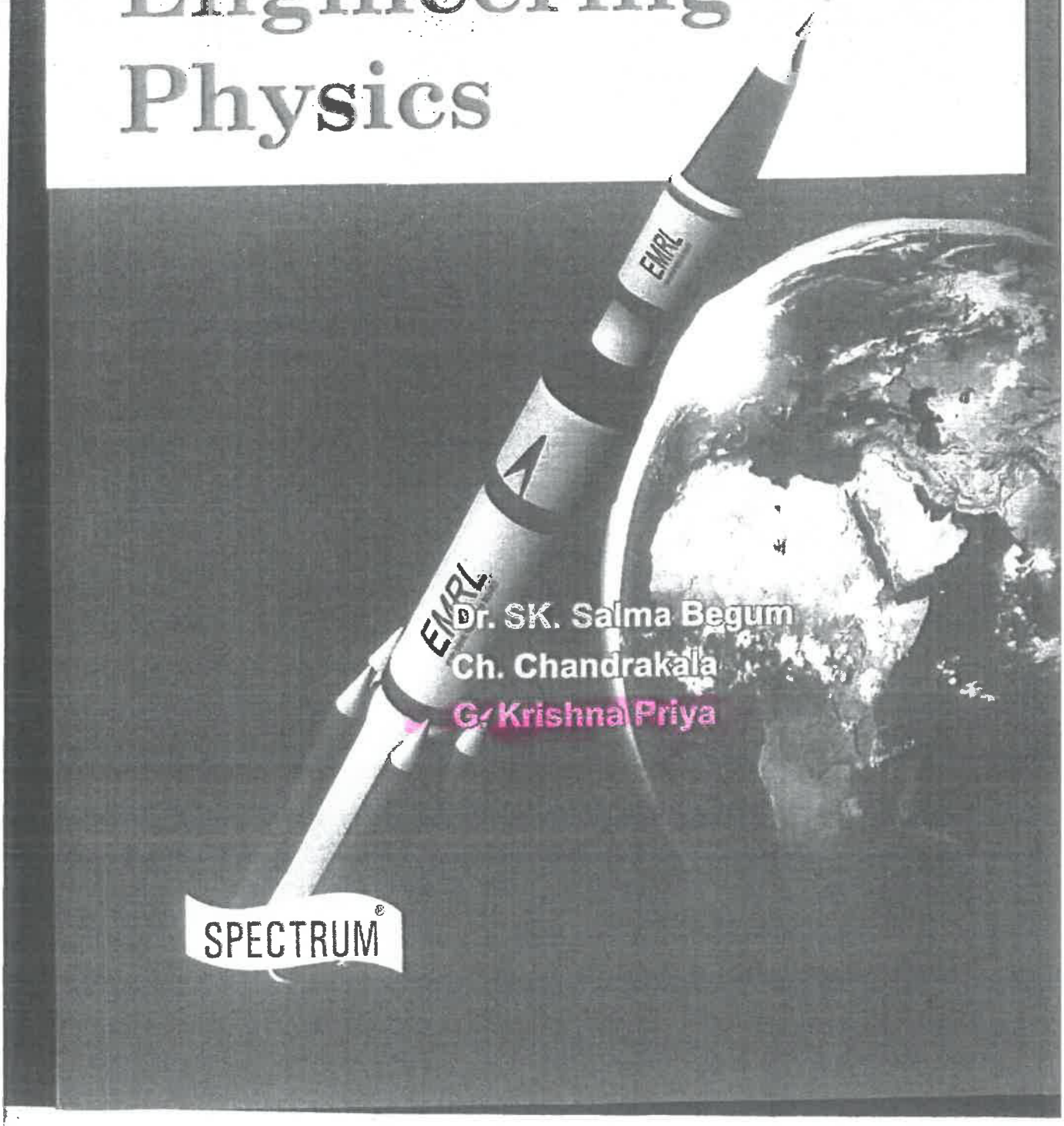

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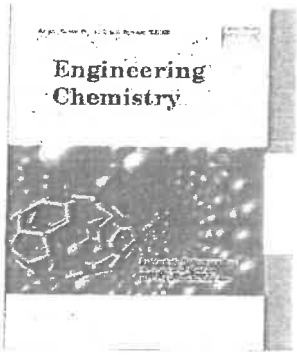

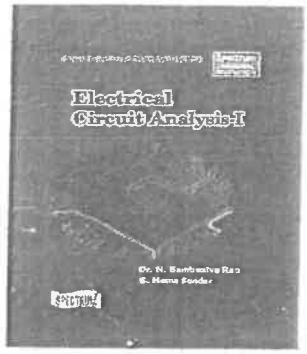

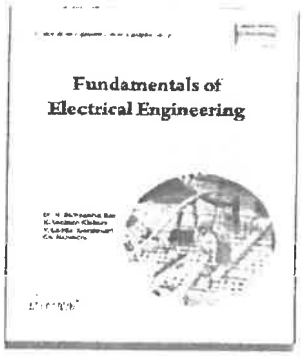

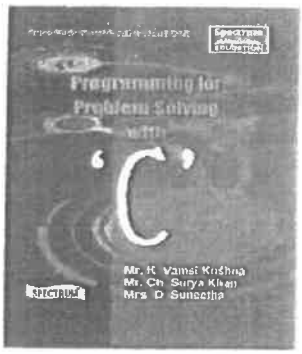

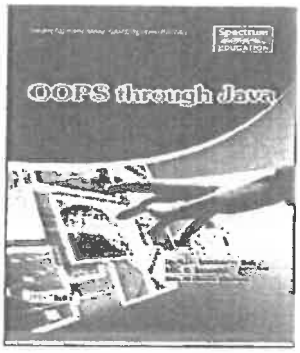

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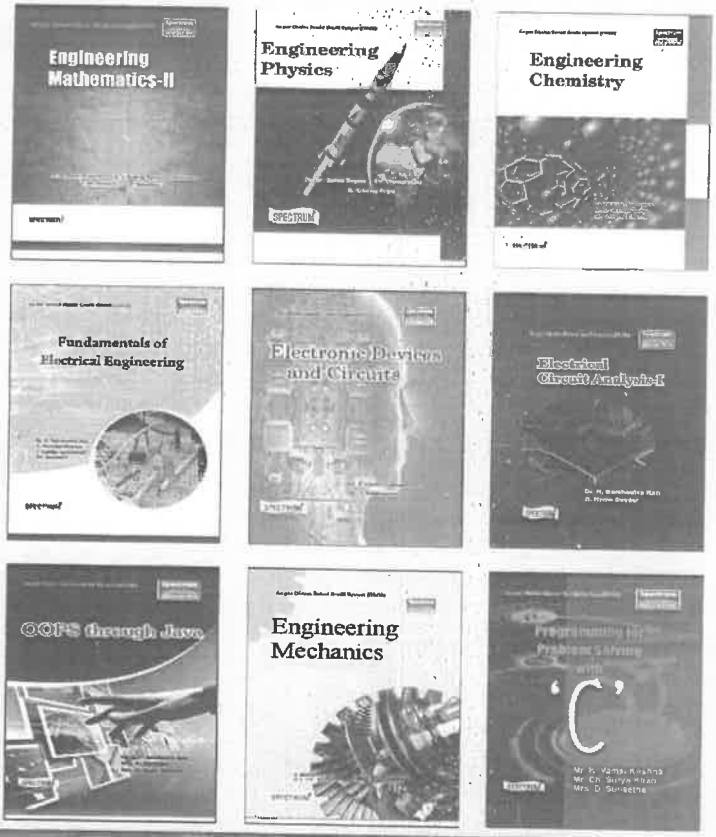

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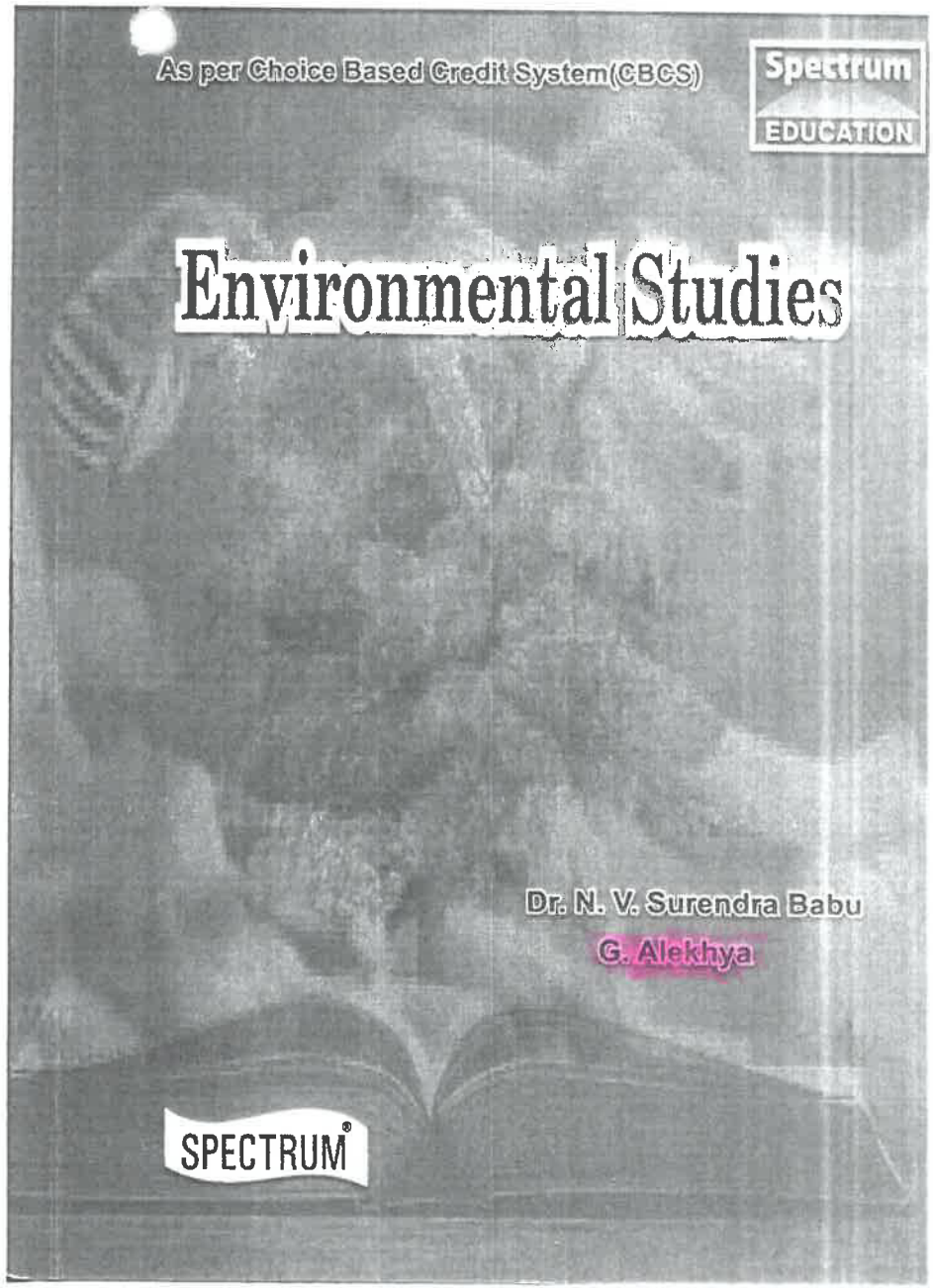
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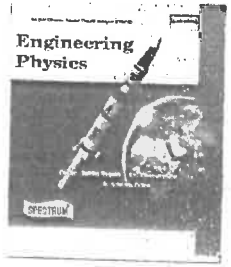

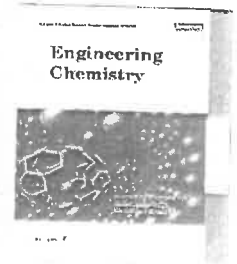

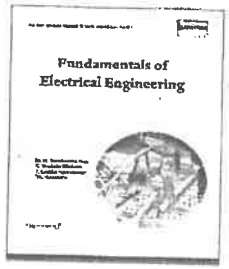

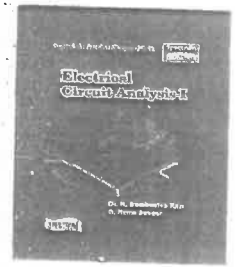

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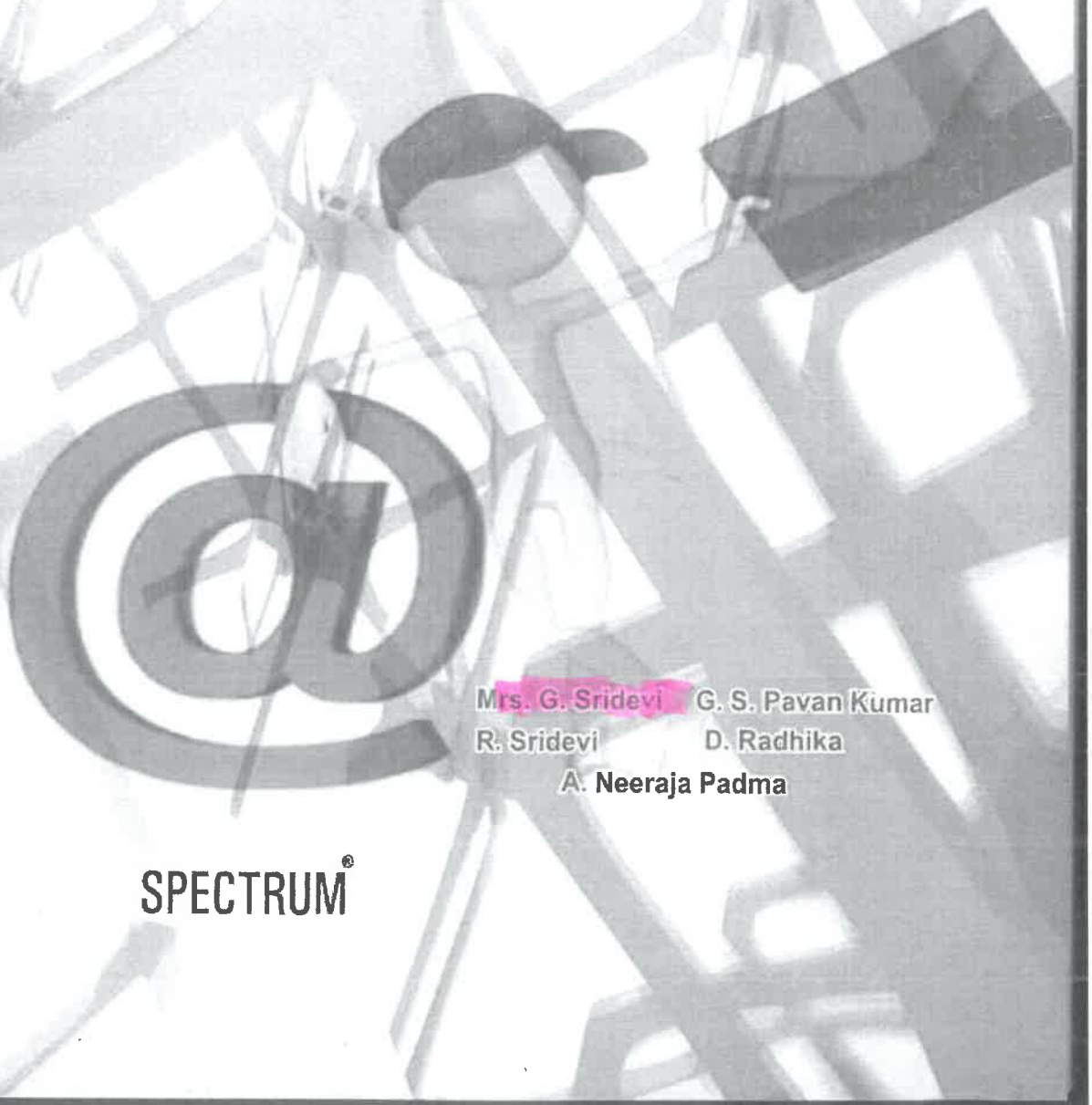

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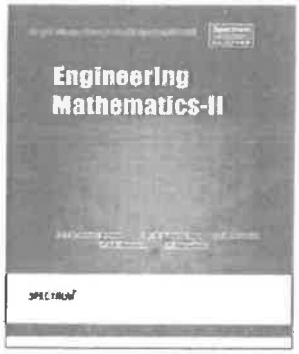

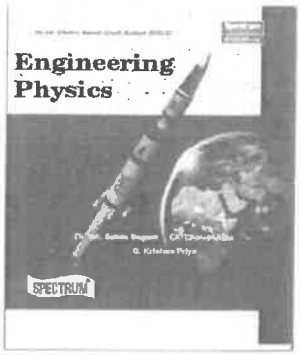

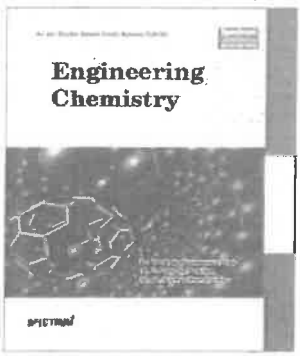

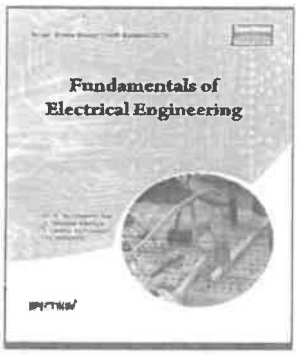

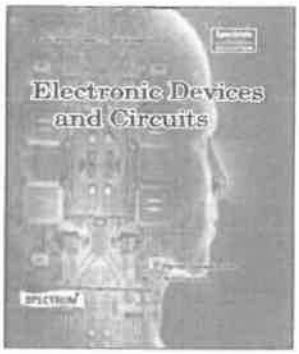

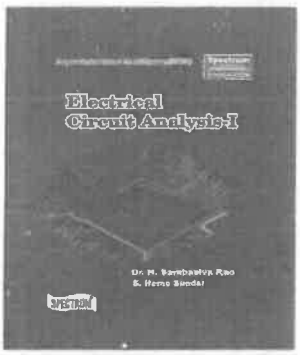

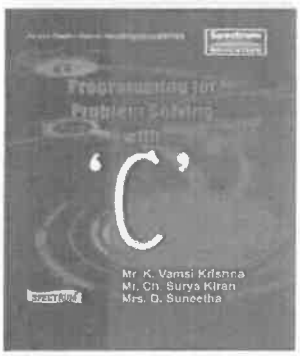

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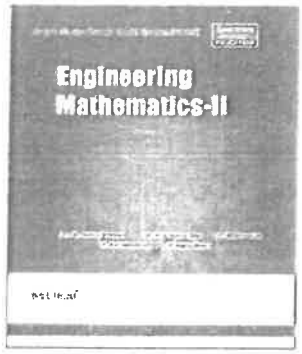

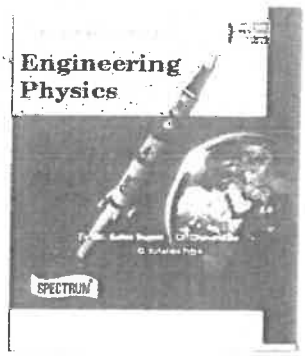

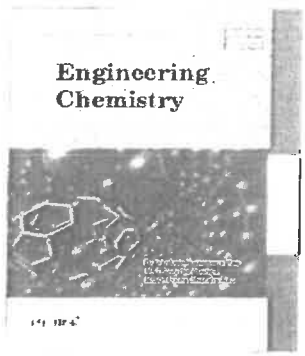

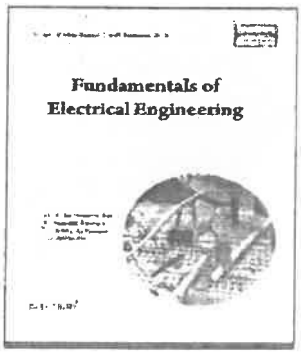

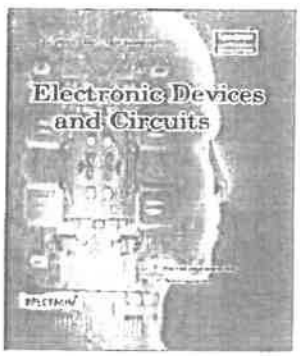

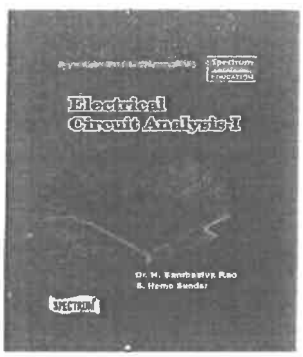

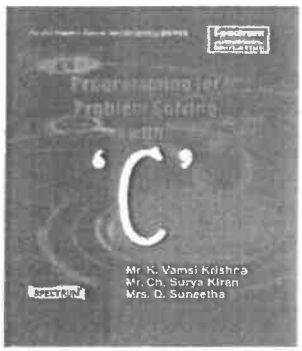

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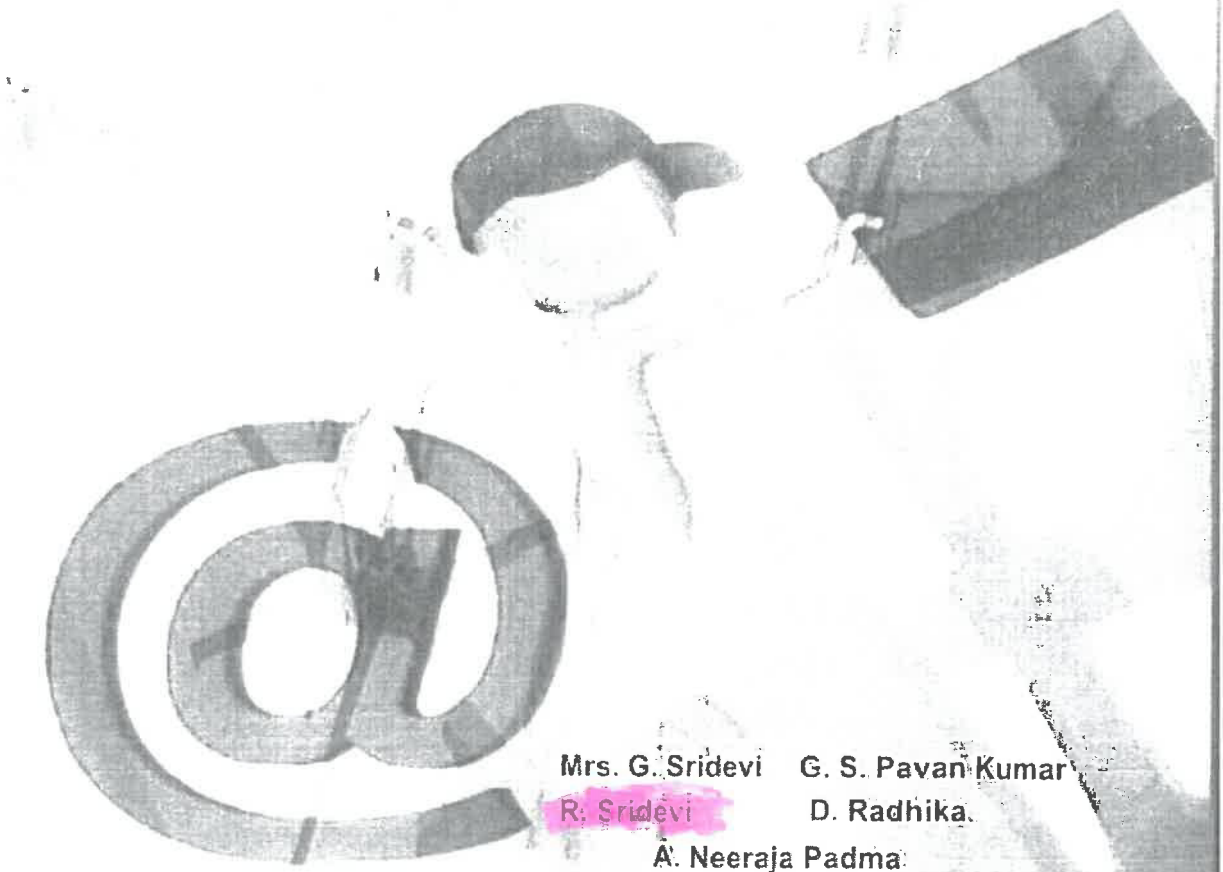

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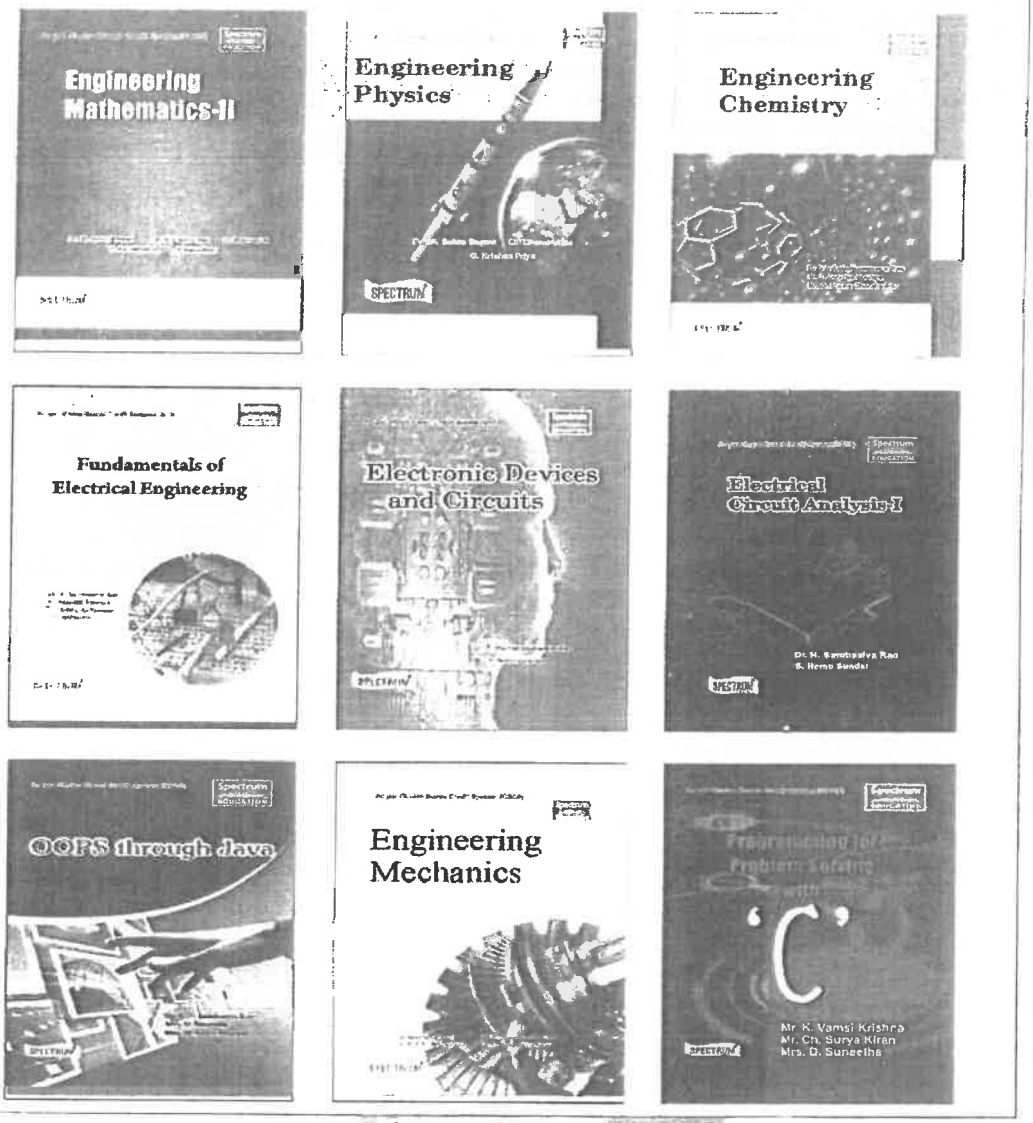

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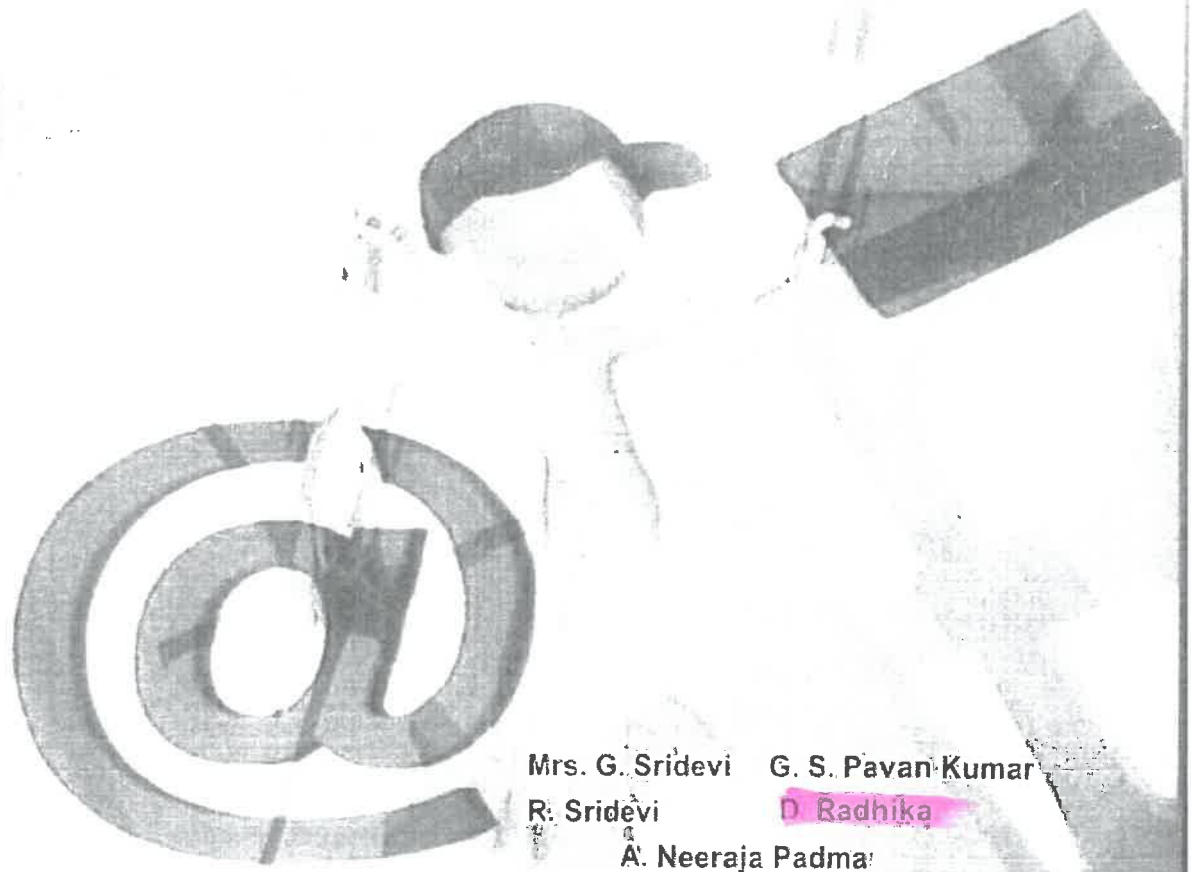

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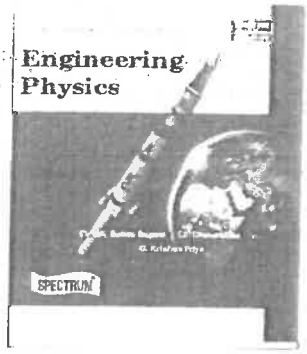

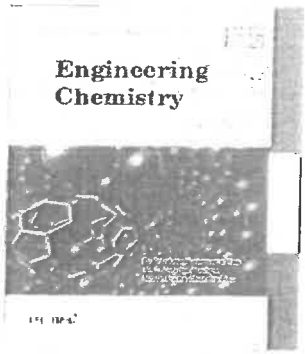

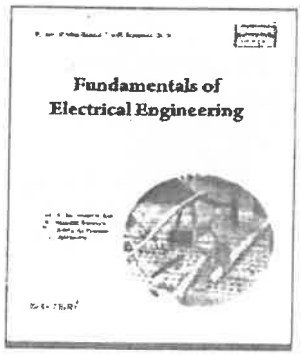

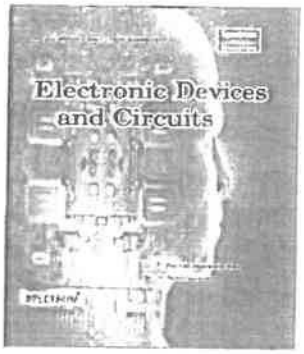

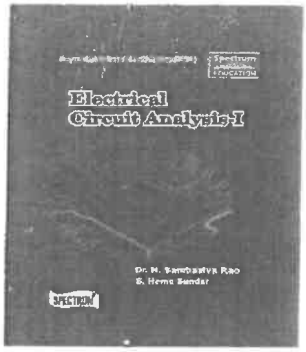

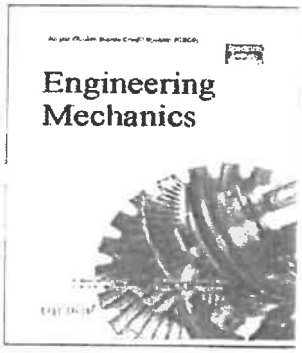

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First Edition-2018

ISBN 978-81-927008-5-0

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Printed at StudentsHelpline Group, S R Nagar, Hyderabad-38
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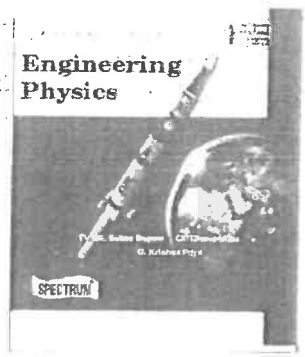

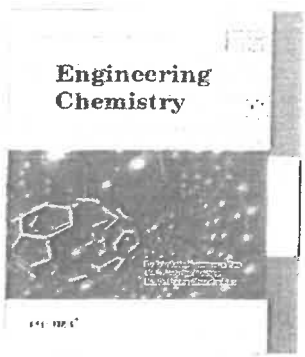

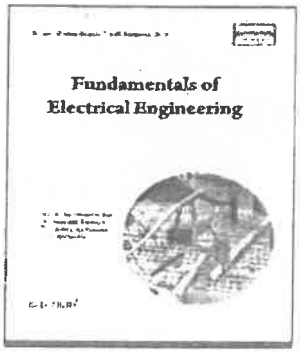

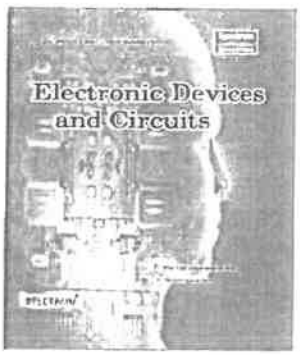

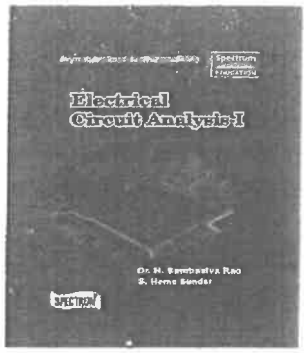

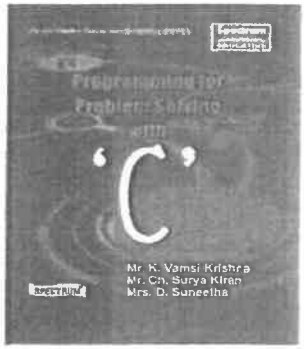

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RIP **Research India Publications**

B-2/84, Ground Floor, Rohini Sector-16, Delhi-110089, INDIA

Published by
Research India Publications
Head Office: B-2/84, Ground Floor,
Rohini Sector-16,
Delhi-110089, INDIA
Fax No.: +91-11-27297815
Email: ripublication@vsnl.net
Website: www.ripublication.com

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Book Code : AMTA

ISBN No. : 978-93-87374-33-1

Price: Within India: Rs. 1500
Outside India: US$ 125

Typeset by RIP INFORMATION SERVICES
B-2/84, Ground Floor, Rohini Sector-16, Delhi-110089 INDIA

Printed in India

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