

# **ESSENTIAL OPERATING SYSTEM CONCEPTS**

**Mrs. K GNANA PRASUNA**

*Assistant Professor*

Department of Computer Science and Engineering  
G. Narayanamma Institute of Technology & Science for Women,  
Hyderabad, Telangana, INDIA

## **ESSENTIAL OPERATING SYSTEM CONCEPTS**

Copyright©

: Mrs. K Gnana Prasuna

Publishing Rights®

: VSRD Academic Publishing

*A Division of Visual Soft India Pvt. Ltd.*

**ISBN-13: 978-81-972449-0-2**

**FIRST EDITION, OCTOBER 2024, INDIA**

*Printed & Published by:*

**VSRD Academic Publishing**

*(A Division of Visual Soft India Pvt. Ltd.)*

**Disclaimer:** The author(s) / Editor(s) are solely responsible for the contents compiled in this book. The publishers or its staff do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the Author(s) or Editor(s) or Publishers to avoid discrepancies in future.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photo-copying, recording or otherwise, without the prior permission of the Publishers & Author.

*Printed & Bound in India*

**VSRD ACADEMIC PUBLISHING**

*A Division of Visual Soft India Pvt. Ltd.*

### **REGISTERED OFFICE**

154, Tezab mill Campus, Anwarganj, KANPUR-208003 (UP) (IN)

Mb:9899936803, Web: [www.vsrdpublishing.com](http://www.vsrdpublishing.com), Email: [vsrdpublishing@gmail.com](mailto:vsrdpublishing@gmail.com)

### **MARKETING OFFICE**

340, FF, Adarsh Nagar, Oshiwara, Andheri(W), MUMBAI-400053 (MH) (IN)

Mb:9956127040, Web: [www.vsrdpublishing.com](http://www.vsrdpublishing.com), Email: [vsrdpublishing@gmail.com](mailto:vsrdpublishing@gmail.com)

# PREFACE

We can easily communicate with technology thanks to an Operating System (OS), which acts as an invisible conductor, orchestrating the symphony of hardware and software. It serves as a link between the user and the computer, offering a seamless user experience and effectively managing resources. The complexity of operating systems, however, continues to be a surprise to many.

The goal of this book is to demystify the world of operating systems and give readers a deeper comprehension of the guiding concepts that shape it. This guide strives to be your dependable companion whether you are an inquisitive beginner, an ambitious software developer, or simply an enthusiast keen to study the inner workings of the digital world.

In this comprehensive overview of operating systems, we'll start with their historical inception and chart their development across time. We will see the amazing developments that have shaped the way we interact with computers, from the early command-line interfaces to the graphical user interfaces (GUIs) that are now commonplace.

We will explore the fundamental elements of operating systems during this voyage, looking at their functions and duties. We will decipher the enigmas of memory management, process scheduling, file systems, and device drivers, illuminating the complex mechanisms that maintain the stability of modern systems.

 *Author*

## ACKNOWLEDGEMENT

Writing this book has been a journey filled with both challenges and triumphs, and I could not have completed it without the support of many incredible individuals.

First and foremost, I would like to thank my son, **Janke Sai Sahshank Reddy** for their unwavering encouragement and patience throughout this process. To my partner, **Janke Ramachandra Reddy** and my daughter **Janke Sai Hasitha Reddy**, their love and understanding have been my anchor. To my parents, **Late K Pandu Ranga Reddy and Mrs. K Saraswathi**, thank you for believing in me and instilling in me the passion for learning.

I would like to thank my publisher, VSRD Academic Publishing, for their professionalism and guidance throughout the publication process. This book would not have been possible without the dedication of the entire editorial team.

Lastly, to my readers—thank you for embarking on this journey with me. This book would not have been possible without your interest and support.

With gratitude,

 *K. Gnana Prasuna*

# TABLE OF CONTENTS

<b>1.</b>	<b>INTRODUCTION TO OPERATING SYSTEM.....</b>	<b>1</b>
1.1.	Introduction .....	1
1.2.	Computer System Organization .....	3
1.3.	Computer System Architecture .....	7
1.4.	Operating System Structure.....	9
1.5.	Process Management.....	12
1.6.	Memory Management .....	12
1.7.	Storage Management .....	13
1.8.	Protection and Security .....	15
1.9.	Operating System Services.....	15
1.10.	User and Operating System Interface .....	17
1.11.	System Calls .....	18
1.12.	System Programs .....	23
<b>2.</b>	<b>PROCESS.....</b>	<b>25</b>
2.1.	Introduction .....	25
2.2.	Schedulers.....	30
2.3.	Context Switch .....	31
2.4.	Thread .....	34
2.5.	Process Scheduling.....	39
2.6.	Preemptive and Non-Preemptive Scheduling.....	40
2.7.	Multilevel Queue Scheduling .....	50
<b>3.</b>	<b>PROCESS SYNCHRONIZATION .....</b>	<b>54</b>
3.1.	Inter Process Communication .....	54
3.2.	Critical Section Problem.....	56
3.3.	Synchronization Hardware .....	60
3.4.	Semaphores (Software Based Solution).....	62
3.5.	Classic Problems of Synchronization .....	65
3.6.	Monitors.....	69
3.7.	Deadlocks .....	73
3.8.	Deadlock Prevention .....	79
3.9.	Deadlock Avoidance.....	81
3.10.	Deadlock Detection .....	88
3.11.	Recovery from Deadlock.....	92

3.12.	<i>Message - Passing System</i> .....	95
<b>4.</b>	<b>MEMORY MANAGEMENT .....</b>	<b>99</b>
4.1.	<i>Address Binding</i> .....	99
4.2.	<i>Swapping</i> .....	103
4.3.	<i>Contiguous Memory Allocation</i> .....	105
4.4.	<i>Fragmentation</i> .....	108
4.5.	<i>Paging</i> .....	109
4.6.	<i>Segmentation</i> .....	119
4.7.	<i>Virtual Memory</i> .....	122
4.8.	<i>Demand Paging</i> .....	124
4.9.	<i>Page Replacement</i> .....	132
<b>5.</b>	<b>FILE MANAGEMENT.....</b>	<b>140</b>
5.1.	<i>Concept of File</i> .....	140
5.2.	<i>File Types</i> .....	144
5.3.	<i>Directory Structure</i> .....	146
5.4.	<i>File Protection</i> .....	150
5.5.	<i>File - System Implementation</i> .....	153
5.6.	<i>Virtual File Systems</i> .....	156
5.7.	<i>Directory Implementation</i> .....	158
5.8.	<i>File Allocation Table (FAT)</i> .....	162
5.9.	<i>Free Space Management</i> .....	166
5.10.	<i>Disk Structure</i> .....	168
5.11.	<i>Disk Scheduling</i> .....	169
5.12.	<i>Disk Formatting</i> .....	174
5.13.	<i>Protection</i> .....	177