



A Study of (a, b)-Fuzzy Sublattices and (a, b)-Fuzzy Ideals of Distributive Lattices

Santosh R. Mitkari, Avinash M. Pawar*, Avinash M. Deshmukh, Tushar R. Shinde
Manoj Tarambale, Sheetal S. Patil



Abstract: The framework of fuzzy algebraic structures is extended to distributive lattices through the introduction and investigation of (a, b)-fuzzy sublattices and (a, b)-fuzzy ideals. Building on foundational work by Zadeh, Rosenfeld, Liu, Sharma, Yuan, Wu, and S. K. Nimbhorkar, this study generalises the perception of (a, b)-fuzzy subrings and (a, b)-fuzzy ideals from ring theory to lattice theory. The paper recalls key definitions and properties of fuzzy subsets in distributive lattices with least and greatest elements to provide the necessary preliminaries. Subsequently, (a, b)-fuzzy sublattices and (a, b)-fuzzy ideals are formally defined, their fundamental properties are investigated, and their relationships with classical fuzzy sublattices and fuzzy ideals are explored. This generalisation offers new perspectives and analytical tools for studying fuzziness in lattice-theoretic contexts.

Keywords: Fuzzy Mathematics, Fuzzy Logic, Algebraic Structures, Distributive Lattice, Fuzzy Ideals, Fuzzy Sublattices, Generalised Fuzzy Algebra

I. INTRODUCTION

The concept of fuzzy sets, first introduced by Zadeh [1] in 1965, has significantly influenced the study of algebraic structures by formalising uncertainty and partial membership.

Rosenfeld [2] subsequently extended this framework to fuzzy groupoids and fuzzy groups. Meanwhile, Liu [3] investigated fuzzy invariant subgroups, fuzzy ideals, and Sharma's [4] α -fuzzy subgroups, broadening the scope of fuzziness in algebra. Yuan and Wu [5] further advanced the field by defining fuzzy sublattices and fuzzy ideals within distributive lattices. Building upon these foundations, S. K. Nimbhorkar [6] presented the idea of (a, b)-fuzzy subrings and (a, b)-fuzzy ideals in ring theory. Motivated by these developments, the present study extends the model of (a, b)-fuzzy subsets to distributive lattices by introducing (a, b)-fuzzy sublattices and (a, b)-fuzzy ideals. The investigators studied lattice structures and properties, including fuzzy distributive lattices [7], fuzzy commutative lattices [6], homomorphisms [8], and fuzzy ideals on fuzzy lattices [9]. The objective is to generalise and analyse these new structures by investigating their properties and interrelationships within lattice theory.

II. METHODOLOGY

The methodology begins by reviewing the fundamental definitions and properties of fuzzy subsets in distributive lattices with least element 0 and greatest element 1. A fuzzy subset κ of a set P is defined as a mapping $P \rightarrow [0,1]$, and the operations on and relations between fuzzy subsets are reviewed. Yuan and Wu's model of fuzzy sublattices provides a basis for further generalisation. The fuzzy subset of L , well-defined by (a, b) with respect to the fuzzy set ω , is then introduced as the fuzzy set ω_b^a of a distributive lattice with 0 and 1, defined by $\omega_b^a(x) = \min\{\omega(x), 1 + b - a\}$ for all x in L , where $0 \leq b < a \leq 1$. Using this construction, (a, b)-fuzzy sublattices and (a, b)-fuzzy ideals of a distributive lattice are defined, with explicit conditions for the lattice meet ($\wedge$) and join ($\vee$) operations. Propositions establish closure properties, including intersection. Illustrative models show that the converse of certain characterisations does not always hold. We use standard techniques in fuzzy lattice theory and compare the results with classical fuzzy sublattice and ideal concepts to highlight the generalisation.

III. PRELIMINARIES

Throughout, L denotes a bounded distributive lattice.

Let's revisit a few key explanations and results.

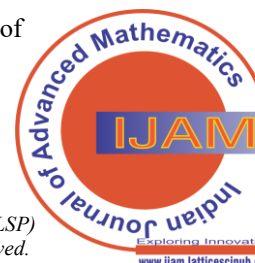
Definition 3.1. [1]

Let P be a nonempty set. A mapping $\kappa: P \rightarrow [0,1]$ is a fuzzy subset of P .

Remark 3.2. [1]

If κ and ϖ are fuzzy subsets of L , then

- i. $\kappa \subseteq \varpi$ if and only if $\kappa(x) \leq \varpi(x)$;



Manuscript received on 05 September 2026 | First Revised Manuscript received on 14 September 2026 | Second Revised Manuscript received on 08 October 2026 | Manuscript Accepted on 15 October 2026 | Manuscript published on 30 October 2026.

*Correspondence Author(s)

Dr. Santosh R. Mitkari, Department of Engineering Science and Allied Engineering, Bharati Vidyapeeth's College of Engineering for Women, Pune (Maharashtra), India. Email ID: santosh.mitkari@bharatividyaapeeth.edu, ORCID ID: [0000-0002-4689-5044](https://orcid.org/0000-0002-4689-5044).

Dr. Avinash M. Pawar*, Department of Mechanical Engineering, Bharati Vidyapeeth's College of Engineering for Women, Pune (Maharashtra), India. Email ID: avinash.m.pawar@bharatividyaapeeth.edu, avibvp@gmail.com, ORCID ID: [0000-0002-5075-0032](https://orcid.org/0000-0002-5075-0032).

Dr. Avinash M. Deshmukh, Department of Basic Science and Engineering, SCTR's Pune Institute of Computer Technology, Pune (Maharashtra), India. Email ID: amdeshmukh@pict.edu, ORCID ID: [0000-0002-7359-057X](https://orcid.org/0000-0002-7359-057X).

Dr. Tushar R. Shinde, Department of Engineering Sciences, Keystone School of Engineering, Pune (Maharashtra), India. Email ID: tushar.shinde@keystonesoe.in, ORCID ID: [0009-0007-9154-8774](https://orcid.org/0009-0007-9154-8774).

Dr. Manoj Tarambale, Professor, Department of Electrical Engineering, PVG's College of Engineering, Technology and Management, Pune (Maharashtra), India. Email ID: manoj_tarambale@yahoo.com, ORCID ID: [0000-0002-9428-8708](https://orcid.org/0000-0002-9428-8708).

Dr. Sheetal S. Patil, Department of Computer Science & Business Systems, Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune (Maharashtra), India. Email ID: sspatil@bvucoep.edu.in, ORCID ID: [0000-0003-4381-1228](https://orcid.org/0000-0003-4381-1228).

© The Authors. Published by Lattice Science Publication (LSP). This is an open-access article under the CC-BY-NC-ND license. <https://creativecommons.org/licenses/by-nc-nd/4.0/>

- ii. $((\kappa \cup \varpi)(x) = \max\{\kappa(x), \varpi(x)\} = \kappa(x) \vee \varpi(x);$
 iii. $(\kappa \cap \varpi)(x) = \min\{\kappa(x), \varpi(x)\} = \kappa(x) \wedge \varpi(x),$ for every $x \in L$.

Definition 3.3. [10]

Let X and Y be nonempty sets, and let $g: X \rightarrow Y$ be a mapping. Let $\kappa \in [0, 1]^X$ and $\varpi \in [0, 1]^Y$. Define the image $g(\kappa) \in [0, 1]^Y$ and the inverse image $g^{-1}(\varpi) \in [0, 1]^X$ as follows: for every $y \in Y$,

$$g(\kappa)(y) = \begin{cases} \bigvee \{\kappa(x) | x \in X, g(x) = y\} & \text{if } g^{-1}(y) \neq \emptyset \\ 0, & \text{otherwise} \end{cases}$$

and $g^{-1}(\varpi)(x) = \varpi(g(x))$ for every $x \in X$.

Definition 3.4. [5]

A fuzzy subset ω of L is a fuzzy sublattice if, for all $x, y \in L$, the following inequalities hold:

- i. $\omega(x \wedge y) \geq \min\{\omega(x), \omega(y)\};$
 ii. $\omega(x \vee y) \geq \min\{\omega(x), \omega(y)\}.$

IV. (a, b)-Fuzzy Sublattice

Sharma [4] introduced the idea of an α -fuzzy subgroup. Bo. Yuan [5] presented the notions of fuzzy sublattice and fuzzy ideal for lattices. We extend these concepts to lattices.

Definition 4.1.

Let ω be a fuzzy subset of the lattice L , and let $0 \leq b < a \leq 1$. The fuzzy set ω_b^a of L , defined by $\omega_b^a(x) = \min\{\omega(x), 1 + b - a\}$ for every $x \in L$, is termed the (a, b)-fuzzy subset of L with respect to ω .

Remark 4.2. [6]

Let ω and η denote fuzzy subsets of X .

Now $(\omega \cap \eta)_b^a = \omega_b^a \cap \eta_b^a$.

Let $g: X \rightarrow Y$ be an onto mapping, and let η be a fuzzy subset of Y .

Define $\eta \circ g: X \rightarrow [0, 1]$ by $(\eta \circ g)(x) = \eta(g(x))$. Then $\eta_b^a \circ g = (\eta \circ g)_b^a$.

Let $g: X \rightarrow Y$ be an onto mapping, and let d, ω , and η be fuzzy subsets of Y .

Then $g^{-1}(\eta_b^a) = (g^{-1}(\eta))_b^a$.

Definition 4.3.

Let ω be a fuzzy subset of L , and let $0 \leq b < a \leq 1$. Then ω is called an (a, b)-fuzzy sublattice of L if ω_b^a is a fuzzy sublattice of L .

This is true if the following conditions hold:

$$\begin{aligned} \omega_b^a(x \wedge y) &\geq \min\{\omega_b^a(x), \omega_b^a(y)\} \\ \omega_b^a(x \vee y) &\geq \min\{\omega_b^a(x), \omega_b^a(y)\}, \text{ for all } x, y \in L \end{aligned}$$

Proposition 4.4.

Every fuzzy sublattice ω of L is also an (a, b)-fuzzy sublattice of L .

Proof. Let $x, y \in L$. Then

$$\begin{aligned} \omega_b^a(x \wedge y) &= \min\{\omega(x \wedge y), 1 + b - a\} \\ &\geq \min\{\min\{\omega(x), \omega(y)\}, 1 + b - a\} \\ &= \min\{\omega_b^a(x), \omega_b^a(y)\} \end{aligned}$$

As ω is a fuzzy sublattice

$$\begin{aligned} &= \min\{\omega(x), 1 + b - a, \min\{\omega(y), 1 + b - a\}\} \\ \omega_b^a(x \wedge y) &= \min\{\omega_b^a(x), \omega_b^a(y)\} \quad (1) \end{aligned}$$

Also,

$$\begin{aligned} \omega_b^a(x \vee y) &= \min\{\omega(x \vee y), 1 + b - a\} \\ &\geq \min\{\min\{\omega(x), \omega(y)\}, 1 + b - a\} \\ &= \min\{\omega_b^a(x), \omega_b^a(y)\} \end{aligned}$$

Since ω is a fuzzy sublattice

$$\begin{aligned} &= \min\{\min\{\omega(x), 1 + b - a\}, \min\{\omega(y), 1 + b - a\}\} \\ \omega_b^a(x \vee y) &= \min\{\omega_b^a(x), \omega_b^a(y)\} \end{aligned}$$

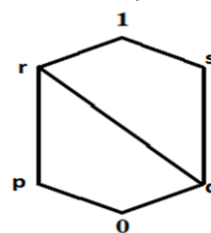
From Equation 1 and Equation 2, it follows that ω is an (a, b)-fuzzy sublattice of L .

The succeeding example demonstrates that the converse of Proposition 4.4 does not necessarily hold.

Example 4.5.

Consider the subsequent fuzzy subset of the distributive lattice L :

$$\omega(x) = \begin{cases} 0.3 & \text{if } x = \{0, q\} \\ 0.4 & \text{if } x = \{p, r, s, 1\} \end{cases}$$



[Fig.1: Distributive Lattice]

Note that for $x = r, y = s, \omega(x) = 0.4, \omega(y) = 0.4$

$$\omega(x \wedge y) = \omega(q) = 0.3$$

This shows that $\omega(x \wedge y) \not\geq \min\{\omega(x), \omega(y)\}$

Thus, ω is not a fuzzy sublattice of L .

For $b = 0.1$ and $a = 0.9$, then $1 + b - a = 0.2$.

$\omega(x) > 1 + b - a$ for all $x \in L$. Therefore

$$\omega_b^a(x) = \min\{\omega(x), 1 + b - a\} = 1 + b - a$$

$$\omega_b^a(x \wedge y) \geq \min\{\omega_b^a(x), \omega_b^a(y)\} = 0.2$$

$$\omega_b^a(x \vee y) \geq \min\{\omega_b^a(x), \omega_b^a(y)\} = 0.2, \text{ for all } x, y \in L$$

Hence ω is an (a, b)-fuzzy sublattice of L , i.e. ω is a (0.1, 0.9)-fuzzy sublattice of L .

Proposition 4.6.

The intersection of two (a, b)-fuzzy sublattices of a lattice L is again an (a, b)-fuzzy sublattice of L .

Proof. Let ω and η be two fuzzy sublattices of L with parameters (a, b).

For any $x, y \in L$, we have

$$\begin{aligned} (\omega \cap \eta)_b^a(x \wedge y) &= (\omega_b^a \cap \eta_b^a)(x \wedge y) \quad \text{by Remark 4.2} \\ &= \min\{\omega_b^a(x \wedge y), \eta_b^a(x \wedge y)\} \\ &\geq \min\{\min\{\omega_b^a(x), \omega_b^a(y)\}, \min\{\eta_b^a(x), \eta_b^a(y)\}\} \\ &= \min\{\min\{\omega_b^a(x), \eta_b^a(x)\}, \min\{\omega_b^a(y), \eta_b^a(y)\}\} \\ &= \min\{(\omega_b^a \cap \eta_b^a)(x), (\omega_b^a \cap \eta_b^a)(y)\} \\ (\omega \cap \eta)_b^a(x \wedge y) &= \min\{(\omega \cap \eta)_b^a(x), (\omega \cap \eta)_b^a(y)\} \quad (2) \end{aligned}$$

Also

$$\begin{aligned} (\omega \cap \eta)_b^a(x \vee y) &= (\omega_b^a \cap \eta_b^a)(x \vee y) \quad \text{by Remark 4.2} \\ &= \min\{\omega_b^a(x \vee y), \eta_b^a(x \vee y)\} \\ &\geq \min\{\min\{\omega_b^a(x), \omega_b^a(y)\}, \min\{\eta_b^a(x), \eta_b^a(y)\}\} \\ &= \min\{\min\{\omega_b^a(x), \eta_b^a(x)\}, \min\{\omega_b^a(y), \eta_b^a(y)\}\} \\ &= \min\{(\omega_b^a \cap \eta_b^a)(x), (\omega_b^a \cap \eta_b^a)(y)\} \end{aligned}$$



$$(\omega \cap \eta)_b^a(x \vee y) = \min\{(\omega \cap \eta)_b^a(x), (\omega \cap \eta)_b^a(y)\} \quad (3)$$

Equations 3 and 4 together imply that $\omega \cap \eta$ is an (a, b) -fuzzy sublattice of L (a, b) -Fuzzy ideal.

Yuan and Wu [5] introduced fuzzy ideals and other types of ideals for lattices. S. K. Nimbhorkar [6] introduced (a, b) -fuzzy ideals of a ring R . We extend this concept to ideals of a lattice.

Definition 5.1. [5]

A fuzzy sublattice ω of L is a fuzzy ideal if, for all $x, y \in L$, $x \leq y$ implies $\omega(x) \geq \omega(y)$.

Definition 5.2.

Let $0 \leq b < a \leq 1$. Let ω be an (a, b) -fuzzy sublattice of L ; then ω is called an (a, b) – fuzzy ideal of L if the following conditions hold:

$$\begin{aligned} \omega_b^a(x \wedge y) &\geq \min\{\omega_b^a(x), \omega_b^a(y)\} \\ \omega_b^a(x \vee y) &\geq \max\{\omega_b^a(x), \omega_b^a(y)\}, \text{ for all } x, y \in L \end{aligned}$$

Proposition 5.3.

Every fuzzy ideal ω of L is also an (a, b) -fuzzy ideal of L .

Proof. Let $x, y \in L$. Then

$$\begin{aligned} \omega_b^a(x \wedge y) &= \min\{\omega(x \wedge y), 1 + b - a\} \\ &\geq \min\{\min\{\omega(x), \omega(y)\}, 1 + b - a\} \end{aligned}$$

Because ω is a fuzzy sublattice

$$= \min\{\{\omega(x), 1 + b - a\}, \min\{\omega(y), 1 + b - a\}\}$$

$$\omega_b^a(x \wedge y) = \min\{\omega_b^a(x), \omega_b^a(y)\} \quad (4)$$

Also

$$\begin{aligned} \omega_b^a(x \vee y) &= \min\{\omega(x \vee y), 1 + b - a\} \\ &\geq \min\{\max\{\omega(x), \omega(y)\}, 1 + b - a\} \end{aligned}$$

Since ω is a fuzzy sublattice of L

$$\begin{aligned} &= \max\{\min\{\omega(x), \omega(y)\}, 1 + b - a\} \\ &= \max\{\min\{\omega(x), 1 + b - a\}, \min\{\omega(y), 1 + b - a\}\} \\ \omega_b^a(x \vee y) &= \max\{\omega_b^a(x), \omega_b^a(y)\} \quad (5) \end{aligned}$$

It follows from Equation 4 and Equation 5 that ω is an (a, b) -fuzzy ideal of the lattice L .

Proposition 5.4.

The intersection of any two (a, b) -fuzzy ideals of L are also an (a, b) -fuzzy ideal.

Proof. Consider two (a, b) -fuzzy ideals, ω and η , of L .

For any $x, y \in L$, we take

$$\begin{aligned} (\omega \cap \eta)_b^a(x \wedge y) &= (\omega_b^a \cap \eta_b^a)(x \wedge y) \quad \text{by Remark 4.2} \\ &= \min\{\omega_b^a(x \wedge y), \eta_b^a(x \wedge y)\} \\ &\geq \min\{\min\{\omega_b^a(x), \omega_b^a(y)\}, \min\{\eta_b^a(x), \eta_b^a(y)\}\} \\ &= \min\{\min\{\omega_b^a(x), \eta_b^a(x)\}, \min\{\omega_b^a(y), \eta_b^a(y)\}\} \\ &= \min\{(\omega_b^a \cap \eta_b^a)(x), (\omega_b^a \cap \eta_b^a)(y)\} \end{aligned}$$

$$(\omega \cap \eta)_b^a(x \wedge y) = \min\{(\omega \cap \eta)_b^a(x), (\omega \cap \eta)_b^a(y)\} \quad (6)$$

Also

$$\begin{aligned} (\omega \cap \eta)_b^a(x \vee y) &= (\omega_b^a \cap \eta_b^a)(x \vee y) \quad \text{by Remark 4.2} \\ &= \min\{\omega_b^a(x \vee y), \eta_b^a(x \vee y)\} \\ &\geq \min\{\max\{\omega_b^a(x), \omega_b^a(y)\}, \max\{\eta_b^a(x), \eta_b^a(y)\}\} \\ &= \max\{\min\{\omega_b^a(x), \eta_b^a(x)\}, \min\{\omega_b^a(y), \eta_b^a(y)\}\} \\ &= \max\{(\omega_b^a \cap \eta_b^a)(x), (\omega_b^a \cap \eta_b^a)(y)\} \end{aligned}$$

$$(\omega \cap \eta)_b^a(x \vee y) = \max\{(\omega \cap \eta)_b^a(x), (\omega \cap \eta)_b^a(y)\} \quad (7)$$

It follows from Equation 6 and Equation 7 that $\omega \cap \eta$ is an (a, b) -fuzzy ideal of L .

V. CONCLUSION

This work extends the framework of fuzzy algebraic structures to distributive lattices by defining and examining (a, b) -fuzzy sublattices and (a, b) -fuzzy ideals. These structures generalise classical notions, providing a broader context for studying fuzziness in lattice theory. We have established fundamental properties and closure under intersection, and counterexamples illustrate the limits of these generalisations. These results lay the groundwork for future research into more complex fuzzy structures in algebra and their potential applications in areas involving graded or uncertain membership, such as logic, information systems, and theoretical computer science.

DECLARATION STATEMENT

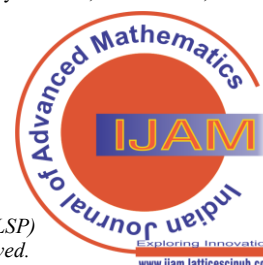
Some of the cited references are older and are noted explicitly as [1], [2], [3], [9] and [10]. However, these works remain significant for the current study, as they are pioneering in their fields.

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been sponsored or funded by any organization or agency.
- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The data in this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is contributed equally to all participating individuals.

REFERENCES

1. L. A. Zadeh, "Fuzzy Sets," Inf. Control, vol. 8, no. 3, pp. 338–353, 1965, DOI: [10.1016/S0019-9958\(65\)90241-X](https://doi.org/10.1016/S0019-9958(65)90241-X), works remain significant; see the [declaration](#)
2. A. Rosenfeld, "Fuzzy Groups," J. Math. Anal. Appl., vol. 35, no. 3, pp. 512–517, 1971, DOI: [10.1016/0022-247X\(71\)90199-5](https://doi.org/10.1016/0022-247X(71)90199-5), works remain significant; see the [declaration](#)
3. W.-J. Liu, "Fuzzy Invariant Subgroups and Fuzzy Ideals," Fuzzy Sets Syst., vol. 8, no. 2, pp. 133–139, 1982, DOI: [10.1016/0165-0114\(82\)90003-3](https://doi.org/10.1016/0165-0114(82)90003-3), works remain significant; see the [declaration](#)
4. P. K. Sharma, "Alpha-Fuzzy Subgroups," Int. J. Fuzzy Math. Syst., vol. 3, no. 1, pp. 47–59, 2013. https://www.ripublication.com/ijfms/ijfmsv3n1_05.pdf
5. B. Yuan and W. Wu, "Fuzzy Ideals on a Distributive Lattice," Fuzzy Sets Syst., vol. 35, pp. 231–240, 1990. DOI: [10.1016/0165-0114\(90\)90196-d](https://doi.org/10.1016/0165-0114(90)90196-d)
6. S. K. Nimbhorkar and J. A. Khubchandani, "(a,b)-Fuzzy Subrings and (a,b)-Fuzzy Ideals of a Ring," J. Hyperstructures, vol. 9, no. 2, pp. 96–114, 2020. https://jhs.uma.ac.ir/article_2633_851a28e3f7e4fd078d0023416fcf807d.pdf
7. M. Wasadikar and J. A. Khubchandani, "Fuzzy Distributive Pair in Fuzzy Lattices," Discuss. Math. Gen. Algebr. Appl., vol. 42, no. 1, pp. 179–199, 2022, DOI: [10.7151/dmgaa.1386](https://doi.org/10.7151/dmgaa.1386)
8. S. G. Korma, R. K. Parimi, and D. C. Kifetew, "Homomorphism and Isomorphism Theorems on Fuzzy Lattices," Res. Math., vol. 10, no. 1,



- pp. 1–12, 2023, DOI: [10.1080/27684830.2023.2255411](https://doi.org/10.1080/27684830.2023.2255411)
9. I. Mezzomo, B. C. Bedregal, and R. H. Santiago, "Types of Fuzzy Ideals in Fuzzy Lattices," J. Intell. & Fuzzy Syst., vol. 28, no. 2, pp. 929–945, 2015, DOI: [10.3233/IFS-141374](https://doi.org/10.3233/IFS-141374), works remain significant; see the [declaration](#)
 10. J. N. Mordeson and D. S. Malik, Fuzzy Commutative Algebra. River Edge, NJ: World Scientific, 1998. DOI: [10.1016/S0020-0255\(00\)00041-4](https://doi.org/10.1016/S0020-0255(00)00041-4). Works remain significant; see the [declaration](#)

AUTHOR'S PROFILE



Dr. Santosh R. Mitkari holds an M.Sc. and PhD in Mathematics and currently serves as an Assistant Professor at Bharati Vidyapeeth's College of Engineering for Women, Pune, India. With 25 years of distinguished teaching and research experience, he has made notable contributions to mathematics education, engineering mathematics, and academic scholarship. Dr Mitkari's academic and research activities are reflected in his publications in reputed national and international journals, including Scopus-indexed journals, highlighting the quality and impact of his research. He has authored 6 journal papers and 2 conference papers that advance mathematical sciences and their applications in engineering education. In addition to his research publications, Dr Mitkari has demonstrated a strong commitment to innovation through two patents, showcasing his engagement in developing novel ideas and practical solutions. His scholarly achievements also include academic authorship, with 32 books prescribed and referenced across nine universities, making a significant contribution to higher education and student learning. His interests include Engineering Mathematics, Applied Mathematics, Mathematical Modelling, Computational Techniques, and Mathematics Education. Throughout his career, he has actively taught, developed curricula, mentored students, and promoted research, earning recognition for his dedication to academic excellence. Dr Mitkari continues to contribute to the academic and research community through quality teaching, scholarly publications, innovation, and the development of educational resources that support engineering and science education.



Dr. Avinash M. Pawar is an accomplished academician, researcher, administrator, and education leader with over 26 years of teaching and professional experience in Mechanical Engineering. He currently serves as Vice Principal, Associate Professor, and Head of the Department at Bharati Vidyapeeth College of Engineering for Women, Pune. He earned his B.E. in Mechanical Engineering from the University of Pune, an M.E. in Mechanical Engineering, and a PhD in Mechanical Engineering from Bharati Vidyapeeth University. Dr Pawar's research interests span advanced manufacturing processes, electrochemical machining, artificial intelligence, renewable energy systems, battery thermal management, machine learning, and smart engineering applications. He has published more than **60 research papers** in reputed Scopus- and Web of Science-indexed journals and conferences and has filed multiple patents in electrochemical machining and smart energy systems. He is a recognised PhD. **Research Guide** at Savitribai Phule Pune University and has served as a referee for doctoral theses. An active contributor to academic governance, Dr Pawar has held numerous leadership positions, including Admission Coordinator, Facilitation Centre Coordinator, Student Welfare Officer, and member of various university and institutional committees. He is also associated with several international journals as Associate Editor, Editorial Board Member, and Reviewer, contributing significantly to engineering education, research, and quality assurance.



Dr. Avinash M. Deshmukh is an accomplished academician, researcher, and academic administrator in Mechanical Engineering with over 26 years of teaching and professional experience. He currently serves as Controller of Examinations at SCTER's Pune Institute of Computer Technology in Pune, Maharashtra, India. He has made significant contributions to engineering education, academic administration, curriculum development, institutional growth, and student mentoring. Dr Avinash M. Deshmukh holds a PhD in Mechanical Engineering from the College of Engineering (COEP), Pune, affiliated to Savitribai Phule Pune University. He completed his M.E. and B.E. in Mechanical Engineering, both with First Class. His teaching and research areas include Mechanical Engineering, HVAC&R, Heat Transfer, Additive Manufacturing, Engineering Drawing, and Computer-Aided Manufacturing. He has 7+ peer-reviewed publications, with several indexed in Scopus and Web of Science. He has 4 Indian patents in his credit.



Dr. Tushar R. Shinde is a dedicated academician and engineering professional with 14 years of teaching and industry experience in Mechanical Engineering. He currently serves as the Head of Department and Assistant Professor, contributing significantly to academic excellence, curriculum development, and student mentoring. Throughout his career, he has strengthened engineering students' technical competence and promoted outcome-based education. His areas of expertise include Computer-Aided Drafting (CAD), Computer-Aided Manufacturing (CAM), Mechatronics and Automation, Robotics, Sensor Implementation in Automation, and Automobile Design. Prof. Shinde is keen on integrating modern automation technologies with manufacturing systems to boost industrial productivity and efficiency. His work bridges theory and practice through project-based learning and industry collaboration. Prof. Shinde has guided numerous undergraduate projects in robotics, automation, and automotive engineering, fostering innovation and problem-solving skills among students. He actively participates in workshops, faculty development programs, and technical seminars to stay abreast of emerging technologies and advancements in engineering education. His commitment to quality teaching, research-oriented learning, and technological innovation has established him as a respected educator and mentor, dedicated to preparing future engineers for the challenges of modern industry and advanced manufacturing environments.



Dr. Manoj Ramesh Tarambale is a distinguished academician, researcher, and administrator in Electrical Engineering with over 30 years of combined academic and industrial experience, including 29 years in academia and one year in industry. He currently serves as Professor of Electrical Engineering at PVG's College of Engineering, Technology and Management, Pune. He holds a B.E. in Electrical Engineering, an M.E. in Control Systems, and a PhD in Electrical Engineering. Dr Tarambale's research interests include control systems, Instrumentation, Biomedical Image Processing, Robotics, Electric and Hybrid Vehicles, Analogue and Digital Electronics, and Illumination Engineering. His doctoral research focused on early lung cancer detection using chest X-ray image-processing techniques. He has published numerous papers in reputable international journals and at conferences and has received several prestigious awards, including the Interscience Young Investigator Award and Best Paper Awards for his research contributions. An active member of professional bodies such as IEEE, ISTE, IAENG, and ISRD, Dr Tarambale has delivered keynote addresses at international conferences across Asia and served in various leadership roles, including Conference General Chair, Program Chair, and Reviewer. He has also contributed significantly to curriculum development, accreditation activities, research promotion, and engineering education at university and institutional levels.



Dr. Sheetal S. Patil is a seasoned academician, researcher, and educator in Computer Engineering, specialising in Artificial Intelligence, Machine Learning, Deep Learning, Cybersecurity, Internet of Things (IoT), Blockchain Technology, and Healthcare Informatics. She earned her PhD in Computer Engineering from Bharati Vidyapeeth Deemed University, Pune, and has made significant contributions to research, teaching, and innovation in emerging computing fields. Her scholarly work encompasses publications in reputable journals, conference proceedings, and international research platforms. It covers topics like medical image synthesis with deep learning, AI-enabled assistive technologies, IoT security, blockchain-based data management, and emotion recognition from EEG signals. Dr Patil is committed to promoting research-based education and interdisciplinary teamwork. Her efforts aim to create intelligent, secure, and socially meaningful technological solutions that tackle practical issues in healthcare, communication, and digital ecosystems. Dr Sheetal S. Patil, Department of Computer Science & Business Systems, Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune, Maharashtra, India.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the Publisher/Journal and/or the editor(s). The Publisher/Journal and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

