KeSEBAE NEWS

Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers

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Welding Engineering

By Yvonne Madahana

Welding Engineering is a sophisticated engineering discipline that extends far beyond the visual spectacle of arcs and sparks. This field encompasses elements of materials science, metallurgy, lasers, design, inspection, quality assurance, and the integration of mechanical, electrical, and electronic systems. Welding engineers are specialists in material joining, leveraging extensive knowledge of physics, engineering principles, metallurgy, materials, and welding standards to design, examine, and evaluate welds. Their expertise also includes planning, supervising, and documenting welding operations in accordance with relevant codes, contracts, and drawings. At its core, welding engineering is inherently interdisciplinary. For example, when selecting materials for fabricating a structure, a welding engineer acts as a material scientist, understanding how metals respond to the heat and stresses of welding. In choosing a welding process, they must grasp the impact of welding parameters on material properties. They must design components with the knowledge that welding can significantly alter material properties.

DEAR READER

Welcome to KeSEBAE Newsletter.

A monthly Newsletter touching on topical issues affecting our environment.

KeSEBAE NEWS is a Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE)

Inside this Issue!

Additionally, welding engineers are tasked with evaluating weld properties without destroying the part, requiring a deep understanding of non-destructive testing methods. The role also demands expertise in electrical engineering to design, build, and troubleshoot automated welding equipment.

Welding engineers play a vital role in ensuring the integrity and durability of metal structures, directly impacting product safety. Their expertise ensures that welding processes are performed correctly, optimizing the strength and efficiency of various metal components. They drive innovation by researching and developing new welding techniques and solutions, catering to the evolving needs of many industries. Without their specialized skills, many modern infrastructural advancements and technological developments would be severely compromised in quality and safety.

Roles of a Welding Engineer

Welding engineers perform a wide range of critical roles:

i. Process Design and Development: Welding engineers identify and select appropriate welding processes (e.g., MIG, TIG, arc welding) based on material properties, project requirements, and desired outcomes. They also develop and document detailed welding procedures, continuously optimizing them to enhance efficiency, quality, and cost-effectiveness.
ii. Material Selection and Metallurgy: Welding engineers analyze and select materials for compatibility between base metals and filler materials while understanding how metal properties change under heat to prevent issues like cracking, distortion, or weakening.
iii. Quality Control and Inspection: Welding engineers inspect welds to meet industry standards using methods like non-destructive testing, NDT, develop quality control procedures to ensure consistency and safety, and analyze defects such as porosity, cracks, and inclusions to implement corrective actions.
iv. Project Management: Welding engineers plan and oversee welding aspects of projects, coordinate with teams to integrate processes, and maintain detailed documentation of procedures, inspections, and quality control measures for compliance and future reference.
v. Safety Management: Welding engineers ensure compliance with safety standards, conduct risk assessments to identify and mitigate hazards, and provide training and supervision to ensure safe welding practices and proper equipment use.

Common Welding Processes

Throughout their careers, welding engineers may encounter various welding processes, each suited to specific applications:

i. MIG – Gas Metal Arc Welding (GMAW): A versatile process that uses an electric arc and continuously fed wire electrode, ideal for welding a wide range of materials, though sensitive to outdoor conditions.
ii. Stick – Shielded Metal Arc Welding (SMAW): A manual welding process using a consumable electrode coated with flux, known for its simplicity and ability to weld various metals even on rusted or dirty surfaces.
iii. TIG – Gas Tungsten Arc Welding (GTAW): Uses a non-consumable tungsten electrode for high-quality, clean welds with excellent control and precision.
iv. Flux-Cored Arc Welding (FCAW): Utilizes a continuous tubular wire filled with flux, known for high deposition rates and versatility, often used in construction and heavy fabrication.
v. Submerged Arc Welding (SAW): Involves covering the welded joint with flux, offering deep welding penetration with reduced fumes and arc visibility.
vi. Oxyacetylene Welding: Uses a flame produced by burning acetylene gas with oxygen, versatile for welding, cutting, and brazing.
vii. Thermit Welding: A high-temperature process using a chemical reaction to

generate heat, commonly used for welding heavy steel components and rail tracks.

viii. Electron Beam Welding (EBW): Fires a high-velocity electron ray at materials, excellent for welding thin or dissimilar materials in a sealed environment.

ix. Plasma Arc Welding (PAW): Similar to TIG welding, but with a plasma torch offering excellent heat localization and control.

x. Resistance Spot Welding (RSW): Joins metal sheets by applying pressure and passing a high electric current at specific points, widely used in automotive manufacturing.

xi. Projection Welding (PW): A type of resistance welding where localized heat is applied to specific areas using projections, common in automotive and appliance manufacturing.

xii. Laser Beam Welding (LBW): Uses a laser as its heat source, suitable for thermoplastics or metals, ideal for large-volume production.

xiii. Electroslag (ESW): Joins thin edges of vertical metal plates using an arc and copper electrode, a semi-automated process requiring specialized equipment.

xiv. Ultrasonic Welding (UW): Joins plastics or metals using ultrasonic vibrations, customized for specific parts.

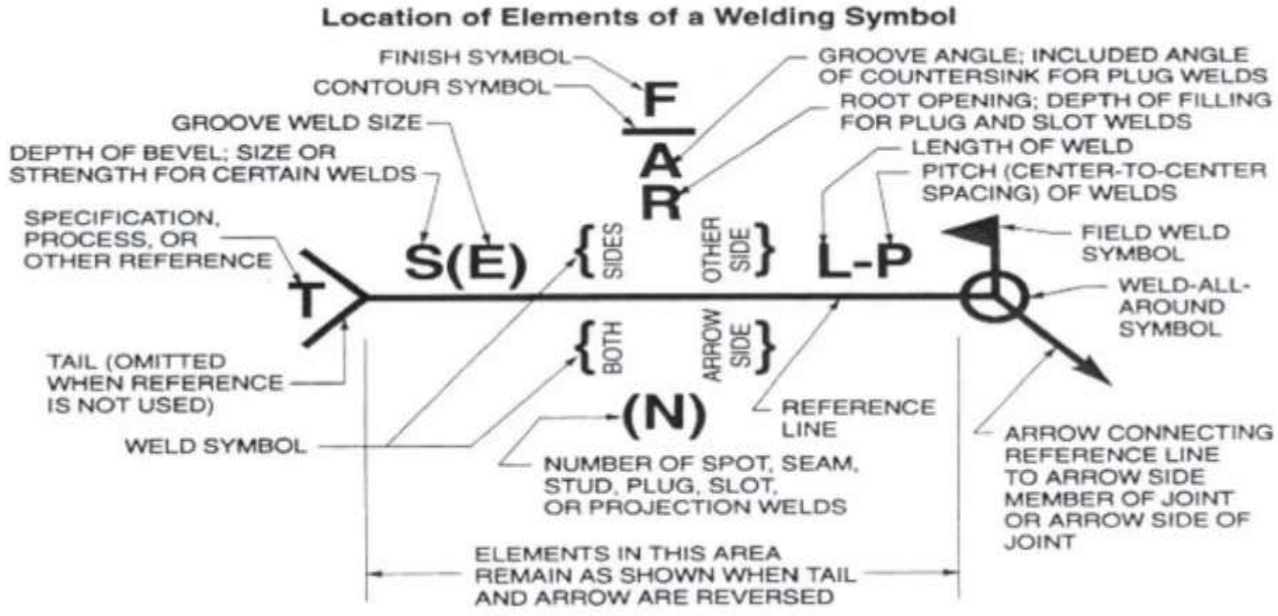
xv. Capacitor Discharge (CD) Stud Welding: Involves a quick electrical discharge to create a molten weld pool, ideal for attaching studs, pins, and fasteners to various metal surfaces.

xvi. Drawn Arc Stud Welding (DAW): Similar to CD stud welding but without a pip, using a welding gun to trigger an arc for molten weld pool creation.

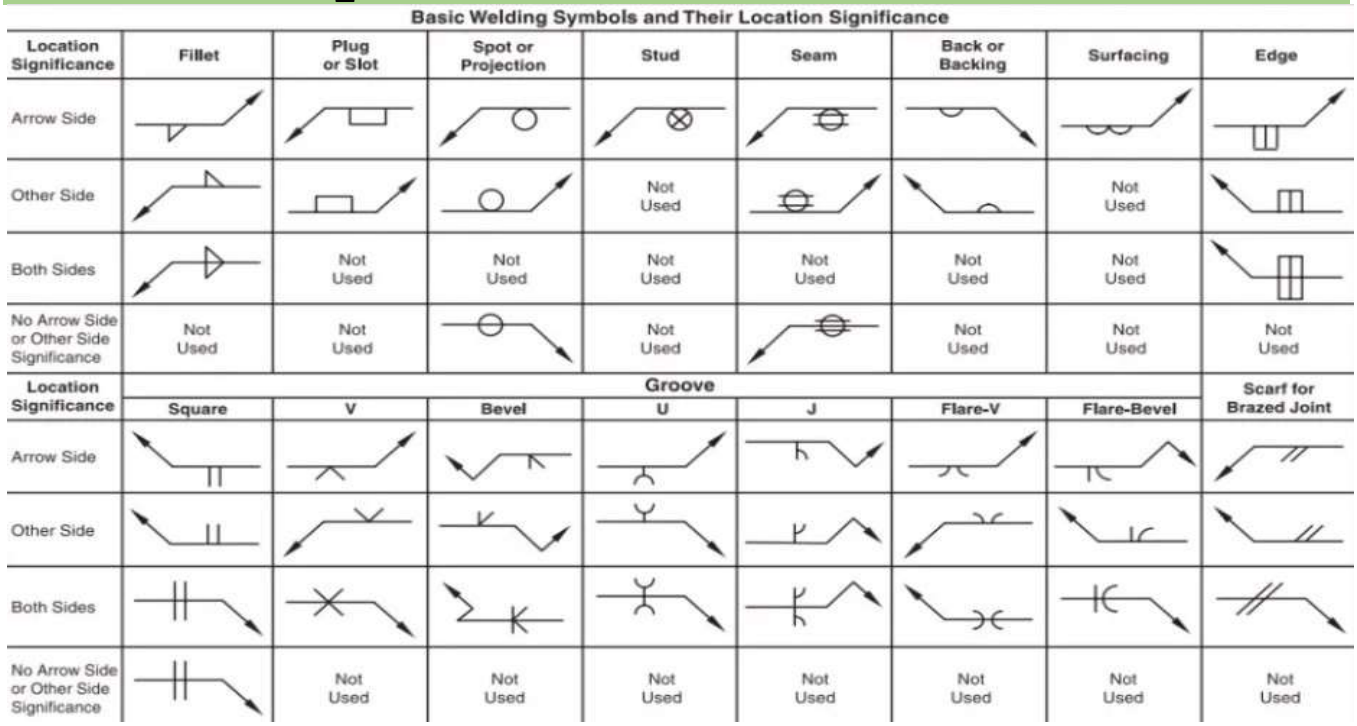
xvii. Short Cycle (SC) Stud Welding: A process where a stud is attached to a metal surface using a short-duration electrical discharge, producing strong welds with minimal distortion.

Understanding Welding Symbols

Welding symbols are standardized representations used on engineering drawings to convey information about welding joints. Welding symbols play a vital role throughout a weld engineering career. Understanding welding symbols is crucial in following the welding procedures by anyone involved in the design, fabrication, and inspection of welded structures. The most common standard is from the American Welding Society (AWS) on how to layout your symbols, which looks as follows:



Picture credit to: ***American Welding Society***



Picture credit to: ***American Welding Society***

Welding symbols are vital for ensuring consistency, accuracy, and quality in welding operations. They help avoid misunderstandings and errors by providing a clear, standardized way of communicating complex welding requirements.

Common Weld Failures

Throughout their career, welding engineers may encounter several common types of weld failures, such as:

- Stress Corrosion Cracks: Occur when metal comes into contact with corrosive materials.
- Hydrogen-Induced Cracks: Result from excessive hydrogen in the weld metal that does not dissolve.
- In-Service Cracks: Caused by residual stress in the heat-affected zone, not always due to welding but other external factors.
- Lamellar Tearing: Occurs parallel to the fusion line, outside the heat-affected zone.
- Brittle Fractures: Fractures across the granular structure without stretching the metal to its yield point.
- Ductile Fractures: Occur when the material stretches to its yield point and then breaks.
- Fatigue Failures: Typically caused by cyclic loading.

Qualifications of a Welding Engineer

The qualifications for a welding engineer typically include a combination of educational background, certifications, technical skills, and relevant experience. Here's an outline of the key qualifications:

1. **Educational Qualifications**
   Bachelor's Degree: A bachelor's degree in welding engineering, materials science, mechanical engineering, or a closely related field is usually required. The curriculum typically covers:
   - Welding processes and technologies
   - Metallurgy and materials science
   - Engineering mechanics and design
   - Thermodynamics and heat transfer

Advanced Degrees (Optional): PhD degree in welding engineering, master's degree in welding engineering or a related field can be beneficial, especially for research, academic, or high-level positions.

2. Certifications

Certified Welding Engineer (CWE): Obtaining this certification from the American Welding Society (AWS) or an equivalent organization is highly valued. The certification process usually involves passing exams that cover:

- Welding fundamentals
- Welding processes
- Welding design and specifications
- Codes and standards

Other Relevant Certifications: Additional certifications can enhance qualifications, such as:

- Certified Welding Inspector (CWI)
- Certified Welding Supervisor (CWS)
- Specific Process Certification (e.g., MIG, TIG, arc welding)

3. Technical Skills

i. Proficiency in Welding Processes: In-depth knowledge of various welding processes like MIG, TIG, stick welding, laser welding, etc.
ii. Metallurgical Knowledge: Understanding of how different materials behave under welding conditions and how to select appropriate materials and processes.
iii. Design and Analysis: Ability to design weldments, interpret welding symbols, and perform stress analysis.
iv. Quality Control and Inspection: Knowledge of welding codes, standards, and inspection techniques.

4. Practical Experience

- Internships Programs: Practical experience during undergraduate studies through internships or cooperative education programs.
- Industry Experience: Several years of experience in the field as a welding technician, welding engineer, or similar role.
- Project Experience: Hands-on experience in welding projects, including designing, planning, and overseeing welding operations.

5. Soft Skills

- Problem-Solving Abilities: Ability to troubleshoot and resolve complex welding-related issues.
- Communication Skills: Strong written and verbal communication skills for reporting, documentation, and collaboration with teams.
- Leadership and Teamwork: Capable of leading teams, managing projects, and working effectively with colleagues from various disciplines.

6. Continuous Learning

- Professional Development: Commitment to staying updated with the latest advancements in welding technology, materials, and industry standards.
- Membership in Professional Organizations: Active participation in organizations like the American Welding Society (AWS) to network, access resources, and stay informed about industry trends.

These qualifications collectively equip a welding engineer with the knowledge, skills, and experience needed to excel in the field and contribute effectively to various industries.

Universities Abroad Offering Degree in Welding Engineering

The demand for skilled Welding Engineers is on the rise worldwide with industries relying on advanced welding techniques for construction, manufacturing, and maintenance. To meet this demand, several prestigious universities abroad offer degree programs specifically tailored to Welding Engineering. These programs provide students with a comprehensive education that blends theoretical knowledge with practical skills, preparing them for successful careers in various industries, including automotive, aerospace, construction, and energy. These universities include:

i. Ohio State University: Bachelor's Degree, PhD and Masters Degree in Welding Engineering under the Department of Materials Science and Engineering

ii. LeTourneau University: Bachelor's Degree in Welding Engineering
iii. Pennsylvania College of Technology: Bachelor's Degree in Welding and Fabrication Engineering Technology
iv. Cranfield University: Master Degree in Welding Engineering and PhD in Welding Engineering (offered within the Welding Engineering and Laser Processing Centre)
v. Ferris State University: Bachelor's Degree in Welding Engineering Technology
vi. University of Alberta: Bachelor's Degree in Welding Engineering and PhD in Welding Engineering
vii. TWI Technology Centre (in partnership with Brunel University London): Master's Degree in Welding Engineering
viii. University of Strathclyde: Master's Degree in Advanced Welding Engineering
ix. Southwest Jiaotong University: Master's Degree in Welding Engineering and PhD in Welding Engineering
x. Harbin Institute of Technology: Master's Degree in Welding Engineering and PhD in Welding Engineering and Automation
xi. University of Pretoria: Master's Degree in Welding Engineering
xii. University of Sheffield: PhD in Welding Engineering
xiii. Texas A&M University: PhD in Mechanical Engineering with research opportunities in Welding Engineering
xiv. RWTH Aachen University: PhD in Welding Engineering (offered within their Institute of Welding and Joining Technology)

In Kenya, while dedicated degrees in Welding Engineering are not yet established, several universities and technical colleges offer courses in welding and fabrication. These programs are typically found within broader disciplines such as Mechanical Engineering, Manufacturing Engineering, or Engineering Technology. The programs are as follows:

- Technical and Vocational Education and Training (TVET) Institutions: Many TVET institutions across Kenya provide specialized training in welding and fabrication. These courses are designed to equip students with practical skills essential for the industrial sector, especially in areas like construction, automotive, and manufacturing.
- Certificate and Diploma Programs: Various institutions, including polytechnics and technical training institutes, offer certificate and diploma programs in welding and fabrication. Examples include Kabete National Polytechnic, Kisumu National Polytechnic, and Kenya Technical Trainers College.
- University Engineering Programs: Some universities offer welding and fabrication as part of their broader engineering curricula. For instance, universities like Jomo Kenyatta University of Agriculture and Technology (JKUAT) and the University of Nairobi incorporate welding as part of their Mechanical and Manufacturing Engineering programs.

The courses offered by these institutions are often accredited by bodies like the National Industrial Training Authority (NITA) and the Kenya National Qualifications Authority (KNQA). Additionally, many graduates obtain certification from professional organizations, which enhances their employability both locally and internationally.

Industries Where Welding Engineers Work

Welding engineers are essential across various industries, including:

- Construction
- Engineering Services
- Automotive
- Aerospace
- Shipbuilding
- Oil and Gas
- Railroads
- Energy
- Manufacturing
- Defense
- Research and Development

- Renewable Energy
- Engineering Consulting
- Education and Training

In summary, welding engineering is a complex and interdisciplinary field that extends beyond the mere act of joining metals. It involves an integration of materials science, metallurgy, design, quality assurance, and mechanical systems. Welding engineers are responsible for ensuring the integrity, strength, and safety of welded structures, requiring a deep understanding of various welding processes and techniques. They play a critical role in numerous industries by optimizing welding methods, designing robust structures, troubleshooting defects, and advancing welding technologies. Their expertise in welding standards, procedures, and codes is essential for maintaining the quality and safety of modern infrastructure.

Reference

Dillon, K. (2024, July 2). "What is weld engineering?". Joiner services. https://joinerservices.io/what-is-weld-engineering/

SAIAE and PASAE Conference 2024

Symposium Costs

The registration fees and accommodation costs for the Symposium can be found in the below table:

	Conference Fee	Conference Fee Incl. Accommodation (3 Nights)		
	Conference Fee Only	House Hoek	Caledon	Arabella
Member Single	$ 380	$ 612	$ 715	$ 1028
Member Sharing	$ 380	$ 552	$ 585	$ 704
Non-member Single	$ 500	$ 720	$ 822	$ 1136
Non-member Sharing	$ 500	$ 660	$ 705	$ 812
Student Fee	$ 195	$ 352	-	-
Day Fee (per day)	$ 185	-	-	-
Virtual member	$ 270	-	-	-
Virtual non-member	$ 380	-	-	-

Partner/Spouse Activities

The Symposium will have an array of relaxing and spectacular activities catered for delegate partners or spouses. The activities that are on offer are as follows:

Day 1 (23 October):
-Franschhoek Wine Tram.
-Babylonstoren Wine Estate.
-Spa @ Caledon.

Day 2 (25 October):
-Table Mountain Cableway.
-Boat Cruise.
-V & A Waterfront

To book an activity or should you require additional information, please contact Ms Londiwe Mbambo - londiwe@saiae.co.za

Virtual Option

We are pleased to inform you that the SAIAE & PASAE Symposium will have a virtual option. Delegates will be able to join us virtually from anywhere in the world to be part of the Symposium and enjoy the presentations that will be at hand.

The fees for the for the virtual option are as follows:

- Virtual members: $ 270
- Virtual non-member: $ 380

Technical Tours

The Symposium Technical Tours set to take place on the 25th of October (Last day of the Symposium) are to be announced in the coming weeks!

Shuttle Services

We are pleased to inform you that shuttle services will be available for delegates travelling between the alternative accommodations and the conference venue.

Important Dates

Symposium Registration Period Opens:	03 May 2024
Abstract Submission Deadline:	16 August 2024
Authors notified of abstract acceptance:	30 August 2024
Preliminary Symposium Programme:	09 September 2024
Proof of payment for all registrations:	04 October 2024
Symposium Commences:	23 October 2024
Symposium Closes:	25 October 2024

The Symposium is supported by the following organizations:

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To endorse or support the Symposium, please contact Mr Senzo Masikane -senzo@saiae.co.za.

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SUB-THEMES

- Green Economy
- Carbon Trading
- Industrialization For Climate Change
- Agricultural Mechanization For Climate Change
- Waste Management For Climate Change
- Energy Systems For Climate Change
- Housing And Infrastructure For Climate Change
- Irrigation and Water Resources
- ICT Systems
- Engineering Education and Practice For Climate Change

KEY DATES:

Abstract Submission: 30 SEPT 2024
Paper Submission: 13 OCT 2024
Payment Deadline : 07 NOV 2024

CHARGES

Members: KES 15,000 ($150)
Non Members : KES 20,000 ($200)
Undergrad Students: KES 2,000 ($20)
Field Visit : KES 5,000 ($50)
Virtual: KES 5,000 ($50)

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CALL FOR ABSTRACTS

Theme:
Engineering Climate Change

Sub-themes

1. Green Economy
2. Carbon Trading
3. Industrialization for Climate Change
4. Agricultural Mechanization for Climate Change
5. Waste Management for Climate Change
6. Energy Systems for Climate Change
7. Housing and Infrastructure for Climate Change
8. Irrigation and Water Resources
9. ICT Systems
10. Engineering Education and Practice for Climate Change

Submission Guidelines

1. Abstract of 250-300 words should be emailed to: events@kesebae.or.ke
2. Abstracts should be inone continous paragraph and include up to 6 keywords for indexing.
3. Abstracts should includethe names of the author(s), affiliations, email and telephone contacts, with the corresponding author inidicated in a footnote.
4. The full paper should be 3,000 - 8,000 words prepared in Times New Roman, font size 12, spacing of 1.5 and in editable text format.
5. All references cited inthe papers should follow APA 6th Edition citation style
6. The full paper should be emailed to events@kesebae.or.ke
7. Abstractsand papers can be submitted/presented either in English or Kiswahili.

Timelines

15th May 2024	30th Sept 2024	13th Oct 2024	7th Nov 2024	27th Nov 2024	3th Dec 2024
Call for Papers	Abstract Submision	Paper Submission	Payment Deadline	Conference	Submission of Full Papers

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JEAE

Journal of Engineering in Agriculture and the Environment

The Journal of Engineering in Agriculture and the Environment (JEAE) is a Publication of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE) through which researchers in the fields of Environment, Agriculture and related fields share research information and findings with their peers from around the globe.

The JEAE Editorial Board wishes to invite interested researchers with complete work in any relevant topic, to submit their papers for publication in the next editions of the Journal.

Manuscripts may be submitted online or via email to:

Chairperson, JEAE Editorial Board via Email: jeae@kesebae.or.ke or Online via: https://kesebae.or.ke/journal/index.php/kesebae/about/submissions

Criteria for Article Selection

Priority in the selection of articles for publication is that the articles:

a. Are written in the English language
b. Are relevant to the application of engineering and technology in agriculture, the environment and biological systems
c. Have not been previously published elsewhere, or, if previously published are supported by a copyright permission
d. Deals with theoretical, practical and adoptable innovations applicable to engineering and technology in agriculture, the environment and biological systems
e. Have a 150 to250 words abstract, preceding the main body of the article
f. The abstract should be followed by the list of 4 to 8 "Key Words"
g. Manuscript should be single-spaced, under 4,000 words (approximately equivalent to 5-6 pages of A4-size paper)
h. Should be submitted in both MS word (2010 or later versions) and pdf formats (i.e., authors submit the abstract and key words in MS Word and pdf after which author uploads the entire manuscript in MS word and pdf)
i. Are supported by authentic sources, references or bibliography

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KeSEBAE NEWS Editorial wishes to call for topical articles for publication in future editions of KeSEBAE NEWS.

Please transmit the same via Email: info@kesebae.or.ke

NOTE: A payment will be made to the author of each selected article

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The annual subscription fees, admission fees and reinstatement fees for members of all grades (except Honorary and Life Members who shall pay no dues or fees) are indicated below: The annual dues are as follows:

Membership Category	Annual Subscription (KES)	Admission Fees (KES)	Reinstatement Fees (KES)
Fellow	5,000	1,000	2,000
Member	2,000	1,000	2,000
Ass. Member	1,000	1,000	2,000
Aff. Member	500	1,000	2,000
Student	300	100	-

Membership Renewal

Members of all grades are requested to renew their **2024 membership as follows.**

Membership Category	*Annual Subscription Fee (KES)*
Fellow	**5,000**
Member	**2,000**
Ass. Member	**1,000**
Aff. Member	**500**
Student Member	**300**

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Branch	**Nairobi University Express Branch**
Account Name	**Kenya Society of Env. Bio. & Agric. Engineers**
Account No.	**2038150696**
Swift Code	**BARCKENX**
Currency	**Kenya Shillings**

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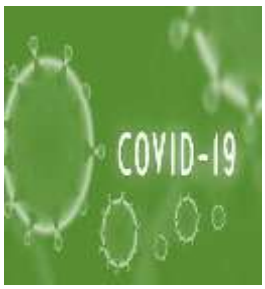
Pay Bill No.: **4002575**
Account No: **Your Full Name**



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