People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
University Mohamed Khider of Biskra
Faculty of Science and Technology
Department of Electrical Engineering

COURSE HANDOUT

MODULE: TECHNICAL ENGLISH

PRESENTED BY:

Professor: **Dr. Abir Boucetta**

Courses intended for second Year Bachelor's degree Students in electrical engineering and renewable energy

2025-2026

Ministry of Higher Education and Scientific Research
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ENGLISH LECTURE HANDOUT

PRESENTED BY:

Dr. Abir Boucetta

For Second Year Students Licence Electrical Engineering and Renewable Energy

OVERVIEW

This handout was developed to assist students in acquiring the fundamentals of scientific and technical English relevant to their field of study. Through carefully selected texts, learners are introduced to specialized vocabulary and grammatical structures that support comprehension and effective communication in scientific and engineering contexts.

The program is designed to deepen students' understanding of technical topics in English by integrating vocabulary-building exercises, idiomatic expressions, and reading comprehension questions. Terminology sections are included to support translation and understanding, particularly between English and French. Additionally, key statements from the texts are provided with translations to reinforce learning and support bilingual understanding.

This material aims to bridge the gap between language learning and technical education, preparing students to engage confidently with English in both academic and professional settings.

SEMESTER 3:

TECHNICAL ENGLISH

COURSE DESCRIPTION

Information of the Course:

- University Mohamed Khider Biskra
- Faculty of science and technology
- Electrical engineering Department
- **Target audience:** For second Year Bachelor's degree Students in electrical engineering and renewable energy
- **Course title:** Technical English
- **Credit:** 01, **Coefficient:** 01
- **Duration:** 15 weeks
- **Evaluation:** Exam 100%
- **Teacher:** Course by: Dr. Abir Boucetta
- **Contact:** by email: abir.boucetta@univ-biskra.dz .

General Objectives:

The student must possess a language proficiency level that enables them to design, analyze, and implement a scientific document, as well as discuss their specialty and field in English with ease and clarity. This course should enable the student to acquire a sufficiently significant level of language to enable him to use a scientific document and speak about his specialty and his field in English, at least with a certain ease and clarity.

Prerequisites:

For the student to easily understand this course, they must be familiar with:

- Self-confidence
- Basic language proficiency (English 1, English 2)
- Ability to read and comprehend

Evaluation method:

- Final exam 100%

CONTENT TABLE

GENERAL INTRODUCTION

General Introduction

Technical English plays an important role in the field of electrical engineering and renewable energy, and acts as a bridge between complex technical concepts and effective communication. In the second year of the study, students reach the depth of the complications of electrical systems and renewable energy technology, making the need for clear and accurate communication even more necessary.

As the students' progress, they will withstand a wide range of technical documents, including research articles, manuals, specifications and project reports. Technical English will enable skills to understand and clarify complex ideas, effectively collaborate with peers and professionals, and disseminate the conclusions and designs with clarity [1].

When it comes to electrical engineering, technical English circuit design is important to describe, analyze electrical systems, explain the component specifications and write reports on experiments and projects. Students will use technical English to talk about building and changing renewable energy systems, how to evaluate the environmental impact and how to report on research results associated with permanent energy solutions. The second year, students will learn technical and special words used in electrical engineering and renewable energy. If they build a fixed foundation in technical English, they will be able to use and understand this language with the right and confidence.

In summary, mastery in technical English during the second year of study is not only a linguistic skill, but an essential educational and professional tool. It gives students the opportunity to succeed in their courses, work effectively collaborate in the professional environment and to make meaningful contributions to dynamic and rapidly developed areas in electrical engineering and renewable energy [2].

The course is structured into four instructional units; each delivered through targeted pedagogical sequences that facilitate understanding of key concepts. These concepts are reinforced through practical activities that allow learners to apply what they have learned—one of the major strengths of this module. Each unit is described below, and a detailed course plan is available online.

a. Introduction

This unit offers a foundational overview of English language basics along with the pedagogical resources available to learners.

b. General Review: Vocabulary, Grammar, and Listening Comprehension

This unit focuses on improving oral comprehension and expression, vocabulary acquisition, and the review of essential grammar structures.

c. Use of Numbers, Symbols, Equations, and Measurement Processes

This unit provides an overview of mathematical numbers and symbols commonly used in equations, as well as an introduction to fundamental physical measurements.

d. Describing Scientific Experiments

This unit introduces the definition and purpose of scientific experiments, with a focus on their application in electrical engineering and renewable energy disciplines.

e. Characteristics of Scientific Texts

This unit explores the structural and stylistic features of scientific texts, the importance of scientific validation, and the correct methodology for writing scientific articles.

Finally, the technical English module plays an important role in equipping electrical engineering students with linguistic, technical and mutual skills required for academic and professional success. Emphasis on hybrid learning methods, practical activities and prominent efficiency -knowledge, skill and professional behavior -This course provides students with units that they need to communicate effectively in English in both local and international engineering environments. Towards the end of the module, students will be better prepared to participate in technical discussions, understand special documents and to contribute confident in global professional surroundings.

COURSE I

GENERAL REVIEW

COURSE I:

GENERAL REVIEW

PART I: Vocabulary and grammar acquisition

LECTURE 1: NOUNS

1-1 Definition of noun

Nouns are essential building blocks of language. They are words that name people, places, things, or ideas. Without nouns, we would struggle to communicate effectively about our world and experiences. [3].

1-2 kinds of noun in English

Nouns can be categorized into several types, typically including:

- **Common nouns**: Generic names for people, places, or things (**e.g**., dog, city, book)
- **Proper nouns:** Specific names for individual people, places, or things (**e.g**., Sarah, Paris, iPhone)
- **Abstract nouns:** Names for ideas or concepts that can't be physically touched (**e.g**., love, freedom, intelligence)
- **Collective nouns:** Names for groups of people or things (e.g., team, flock, family)
- **Concrete nouns:** Names for things that can be perceived by the senses (**e.g**., chair, water, sunlight)

1-3 Plurals

A/- The plural of a noun is usually made by adding **s** to the singular:

E.g. day→ days house→ houses

1-3-1 Other plural forms

B/- Nouns ending in **o or ch, sh, ss or x** forms their plural by adding **es:**

E.g. tomato→ tomatoes; church→ churches; brush→ brushes;

kiss→ kisses**;** box→ boxes

But words of foreign origin or abbreviated words ending in **o** add **s** only:

E.g. photo→ photos piano→ pianos kilo→ kilos

C/- Nouns ending in **y** following a consonant form their plural by dropping the **y** and adding **ies**: e.g.

Country→ countries lady→ ladies

* Nouns ending in **y** following a vowel form their plural by adding **s:**

E.g. boy→ boys day→ days

D/- Twelve (12) nouns ending in **f** or **fe** drop the **f** or **fe** and add **ves**.

These nouns are: ***calf,half, knife, leaf, life, loaf, self, sheaf, shelf, thief, wife, and wolf.***

E.g. Life→ lives wife→ wives

* The nouns ***hoof***, ***scarf*** and ***wharf*** take either **s** or **ves** in the plural:

E.g. hoofs or hooves, scarfs or scarves, wharfs or whaves

E/- A few nouns form their plural by a vowel change:

E.g. foot→ feet m**a**n→ m**e**n m**ou**se→ m**i**ce

t**oo**th→ t**ee**th woma**n**→ wom**e**n g**oo**se→ g**ee**se

l**ou**se→ l**i**ce

*The plurals of ***child*** and ***ox*** are ***children*** and ***oxen***.

F/- Collective nouns, crew, family, team etc. can take a singular or plural verb; singular if weconsider the word to mean a single group or unit: e.g. our team is the best.

or plural if we take it to mean a number of individuals:

E.g. our team are wearing their newjerseys.

G/- Compound nouns:

1- Normally the last word is made plural: e.g. boy-friend→ boy-friend**s**

2- The first word is made plural with compounds formed of

noun+ preposition+ noun.

E.g. Sisters- in law

1-3-2 Uncountable nouns (also known as non-count nouns or mass nouns)

****Names of substances*** considered generally: e.g. bread, cream, oil

****Abstract nouns***: e.g. advice, beauty, courage, fear

Uncountable nouns are always singular and are not used with a/an: e.g. I don't want (any) advice or help. I want (some) information.

These nouns are often preceded by ***some, any, no, a little***

a love+ of/ a dislike+ of

E.g. a love of music.

Example 1: Give the plural of each word:

1- girl→ **girls**

2- city→ **cities**

3- box→ **boxes**

4- tooth→ **teeth**

5- life→ **lives**

Example 2: Find the nouns that correspond to the following verbs:

Infiltrate- **Infiltration**	test- **test**	compress- **compression**
Develop- **development**	infect- **infection**	distill- **distillation**

LECTURE 2: VERBS AND TENSES

2-1 **Definition of verb:** A verb is any action (walk), occurrence (happen), or state of being (be).A word indicating action or a state [3].

2-2 **Categories of verbs:** there are different types of verbs corresponding closely to different types of objects and Complement.

2-2-1 **Extensive verbs:** can be either transitive or intransitive. They are intransitive if they don'tpermit any of the four objects and complement types i.e. Od, Oi, Cs, Co

E.g. It (s) rained (v) steadily (A) all day (A).

A/- Transitive verbs take a direct object. Some in addition, permit an indirect object. A fewverbs take an object complement.

- ***Negative form***

The simple present tense: third person singular does not/ doesn't+ infinitive; other persons donot/ don't+ infinitive.

· The simple past tense negative for all persons is did not/ didn't+ infinitive.

· Contractions are usual in speech

- He does not/ doesn't answer letters.

- They do not/ don't live here

- I did not/ didn't phone her.

· The negative for all other tenses is formed by putting not after the auxiliary.

- He has not/ hasn't finished / - He would/ wouldn't come.

- ***Interrogative form***

. Simple present tense interrogative: do I / you/ we/ they +infinitiveDoes he/ she/ it + infinitive

E.g. Does Peter enjoy party?

. Simple past tense interrogative: did + subject+ infinitive.

E.g. Did he enjoy Ann's party?

- **Wh –questions:** the wh- questions (which, when, why, where, what, who, whose and how) are a special set of pro- forms used in questions to ask for the identification of

subject, object, complement, or an adverbial of a sentence.

E.g. They (1) make him (2) the chairman (3) every year (4).

(1) **Who** makes him the chairman every year?

(2) **Whom** do they make the chairman every year?

(3) **What** do they make him every year?

(4) **When** do they make him the chairman?

- **Yes- no questions:** Besides wh questions, which elicit information on particular parts ofa sentence, there are questions which seek a yes or no response in relation to the validity of an entire predication.

(1) Is the girl now a student?

(2) Did john search the room carefully?

(3) Has he given the girl an apple?

- **Interrogative negative form**

Isn't the girl a student? OR Is the girl not a student?

Didn't John search the room? OR Did John not search the room?

Hasn't he given the girl an apple? OR Has he not given the girl an apple?

2-2-2 Regular and irregular verbs

- **Regular verbs:** Verbs that form their past tense and past participle by adding -ed (e.g., walk → walked).
- **Irregular verbs:** Verbs that do not follow the regular -ed rule. Their past forms vary (e.g., go → went, eat → ate).

Exercise: Write the past simple and the past participle of these verbs:

Verb	**Past Simple**	**Past Participle**
Find	Found	Found
Ask	Asked	Asked
Break	Broke	Broken
Listen	Listened	Listened
Begin	Began	Begun
Cut	Cut	Cut

LECTURE 3: ADJECTIVES AND ADVERBS

3-1 Adjective: is a word that describes or modifies a noun or pronoun.it gives more information about what kind, which one, how many, or how much. [4]

E.g. The unhappiest, richest man / a solid commitment.

Example:

- She has a beautiful eye.

("Beautiful" describes the noun "eyes")

3-2 Attribute and predicative adjectives

The major syntactic function of adjectives is attribute and predicative.

A/- **Determiner – adjective- noun,**

E.g. a **pleasant** holiday. (Attribute adjective).

B/- **Subject- verb- subject complement** (adjective),

E.g. The holiday is pleasant (predicative adjective)

C/- **Subject- verb- object- object complement** (adjective),

E.g. we made him happy (predicative adjective).

The large majority of adjectives may be used attributively and predicatively.

** However, such adjectives are attribute only e.g. (only, Roman)

E.g. A Roman holiday.

** The adjectives "ill" and "afraid" are predicative only.

E.g. The soldier is afraid.

** Some adjectives change their meaning when moved from one position to the other.

E.g. A small farmer is a man who has a small farm, but the farmer is small means that he is asmall man physically.

3-3 Adverb: is a word that modifies a verb, an adjective, another adverb, or a sentence.it gives more information about how, when, where, how often, or to what extent something happens [4].

Example:

- She sings **beautifully**.

- It's **very** cold.
- He runs **quite** quickly.

3-4 Kind of adverbs:

- **Manner**: describe **the way** something happens or is performed, (bravely, fast, and hard).

E.g. He works hard

- **Place**: tell **where** something happens, (away, everywhere, here, nowhere, there…. Etc)

E.g. She went away.

- **Time**: tell **when** something happens afterwards, (eventually, lately, recently, tomorrow)

E.g. I will wait till tomorrow.

- **Frequency**: tell **how often** something happens (always, continually, frequently, once, repeatedly, never).

E.g. He can never understand.

- **Degree**: tell **how much or to what extent** something happens, (almost, barely, so, too, fairly, extremely).

E.g. I am almost ready.

- **Sentence**: these modify the whole sentence or clause and normally express the speaker's opinion, (certainly, definitely, luckily, surely, honestly).

E.g. He certainly works hard

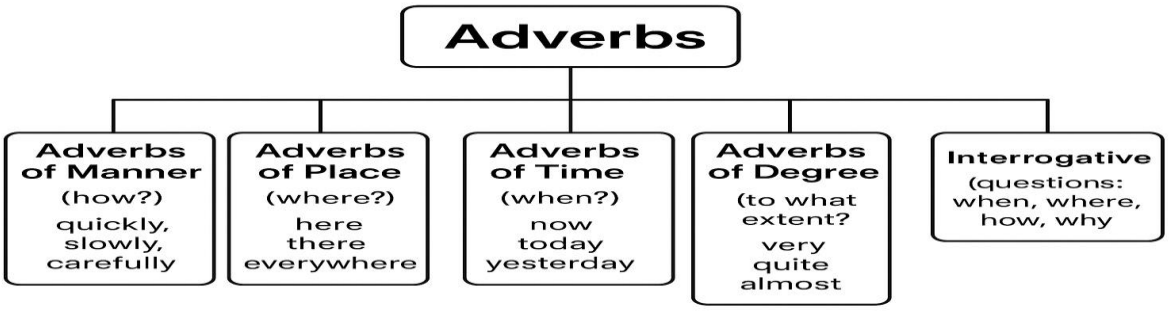


Figure.1: Kind of adverbs

3-4-1 Interrogative adverbs: are adverbs used to ask questions. They ask about: time-when, place-where, reason- why, manner- how. E.g. why was he late?

3-4-2 Relative adverbs: when, where, why. E.g. The year when he was born.

	Used as adverbs	**Used as adjectives**
Back	Come back soon	The back door
Hard	They work hard	The work is hard
Fast	The train went fast	A fast train
Right	Turn right here	The right answer
Straight	She went straight home	A straight line
Wrong	He led us wrong	This is the wrong way

Example:

Fill in the gaps with the right word: only, suspiciously, ever,old, obviously, where.

a- He looked at me **suspiciously**

b- Have you **ever** ridden a camel?

c- He is **obviously** intelligent.

d- The hotel **where** they were staying.

e- He is my **only** son.

f- This house is **old**

LECTURE 4: COMPARATIVES AND SUPERLATIVES

4-1 Comparatives

We can use comparative adjectives to show how two people or objects are different. You need to use "more" to express this which has slightly better quality, size or characteristics. When you want to say that something or someone is of low quality, size or characteristics, you should use "less" instead of "more" [5].

4-1-1 More

The way we make a comparative with 'more' depends on the length of the word. There are three different cases:

- ***More for long adjectives.***

If an adjective has two or more syllables, we add the word 'more' in front to create the

comparative form.

For example:

- This hotel is more expensive than the last hotel we stayed at.
- Reading is more interesting than watching television.
- The sea here is more beautiful than the sea in my country

- ***-er for short adjectives***

If an adjective has one syllable, or two syllables with -y as the second syllable, we add -er tocreate the comparative.

For example:

- Your house is bigger than mine.
- Taking the bus is cheaper than taking the car.
- This box is heavier than that one.

As you can see in the first example, if an adjective ends in a vowel and consonant (e.g. *big*) youneed to double the final consonant.

For example: *bigger, fatter, and thinner.*

- ***Irregular comparatives***

As is often the case in English, there are some adjectives that are irregular and don't followthese rules. Here are the irregular comparatives:

Good	Better
Bad	Worse
Far	Further (U.K) / farther (U.S)
Fun	Fun

For example:

- Your cooking is better than my cooking.
- Arriving late is worse than arriving early.
- Their house is further from here than our house.
- Going out is more fun than staying at home.

4-1-2 Using 'than'

When you refer to the two people/things you are comparing, you need to use 'than'.

For example,

- Living in the city is better than living in the country

But if it's clear what you're referring to, it's also possible to make a comparison withoutrepeating one of the things, and in this case, you don't need to use 'than'.

For example:

- Living in the city is more expensive.

4-1-3 Less

We use 'less' to say that someone or something has an inferior quality, size or characteristic. It'seasy to use because you simply put 'less' in front of any adjective.

For example:

- Walking is less tiring than running.
- Australia is less populated than China.
- Hamburgers are less healthy than vegetables.

4-2 Superlative

We use superlatives to compare one person or thing to several others. Also used to show that something has highest or lowest degree of quality when comparing three or more people, things, or groups [5].

For example:

- Algeria is the most beautiful city I've ever seen.

This means that I've seen several cities and I consider Algeria as the number one in terms of being beautiful.

In a similar way to comparatives, there are two ways to use superlatives. When you want to say that one person or thing is superior to all others in that group, you need to use 'the most'. When you want to say that one person or thing is inferior to all others in that group, you need to use 'theleast'.

4-2-1 The most

Similarly to comparatives, we use 'the most' in different ways according to the length of the adjectives:

- ***'The most' for long adjectives***

If an adjective has two or more syllables, we add 'the most' in front to create the superlative form.

For example:

- She's the most determined candidate we've seen today.
- It's the most difficult part of my job.
- This is the most successful year the companies ever had.

- ***'est' for short adjectives***

If an adjective has one syllable, or two syllables with -y as the second syllable, we add -est tocreate the superlative.

For example:

- It's the shortest route to the stadium.
- What's the longest flight you've ever taken?
- He's the nicest guy I've met here.

As with comparatives, if an adjective ends in a vowel and consonant (e.g. *sad*) you need todouble the final consonant.

For example: *saddest, fittest, and hottest.*

- ***Irregular superlatives***

The same adjectives that are irregular for comparatives are also irregular for the superlative form:

Good	Best
Bad	Worst
Far	Furthest/farthest
Fun	Fun

Here are some examples:

- Is this the best place to eat in town?
- Yesterday's performance was my worst ever.
- Alaska is the furthest state from Florida.

- That was the most fun I've had in a long time!

4-2-2 The least

We use 'the least' to say that someone or something has an inferior quality, size or characteristic compared to all others of its type. Simply put 'the least' in front of any adjective.

For example:

- Cleaning the floor is my least favorite type of housework.
- The least difficult tense in English is the present simple.
- He's the least active person I know. He's very lazy.

4-2-3 As … as

There is another way to compare people and things in English which is using *as* + adjective + *as.*

We use this form to say that things are or aren't the same.For example:

- I'm as tall as my brother. (We are the same height.)
- This book isn't as good as that one. (The quality of the books is not the same.)
- Are you as hungry as I am? (Are we hungry in the same way

LECTURE 5: PRONOUNS AND POSSESSIVES

5-1 Pronouns

Definition: Pronouns are words that take the place of nouns to avoid repetition and make sentences clearer or less repetitive [6].

E.g. he, she, it, they, we, you, I, this, who

Example:

Sara is my friend. She is very kind.

("She" replaces "Sara")

5-2 Possessives

Definition: Possessives show ownership or belonging. They can be possessive pronouns or possessive adjectives.

- **Possessive Adjectives** (used before nouns): my, your, his, her, its, our, their

Example: Her book is on the table.

- **Possessive Pronouns** (stand-alone): mine, yours, his, hers, ours, theirs

Example: That book is hers.

	Personal pronouns		**Possessive**		
	subject pronouns	**complement pronouns**	**Possessive adjectives**	**Possessive pronouns**	**reflective pronouns**
Singular	I	Me	My	Mine	Myself
	You	You	Your	Yours	Yourself
	He	Him	His	His	Himself
	She	Her	Her	Hers	Herself
	It	It	Its	*	Itself
Plural	We	Us	Our	Ours	Ourselves
	You	You	Your	Yours	Yourselves
	They	Them	Their	Theirs	Themselves

5-3 Activities and exercises

Exercise 1: write the present simple form of the verbs in table

Verb	**Past Simple**	**Past Participle**
Come		
		Done
	Spoke	
Forbide		
	Knew	
		Learned

Exercise 2: Put the Adjectives between Brackets in the Correct Form

1. She is…….. (tall) than you are.

2. I am……... (exhausted) than her.

3. She is ……(happy) than him.

4. He is ……..(good) at maths than me.

5. That film is ……..(bad) than this one.

Exercise 3: Put the Adjectives between Brackets in the Correct Form

1. My sister thinks she's (intelligent) than me, but I don't agree!
2. *Avatar* is probably (bad) film I've seen!
3. What is (wet) month of the year in England?
4. Do you think the *Harry Potter* films are (good) than the books?
5. Who is (powerful) person in your country?
6. I think *Men in Black 1* was (funny) than *Men in Black 3*.
7. Is Angelina Jolie (old) than Sandra Bullock?
8. John is (nice) person that I know.

Exercise 4: What Is the Correct Plural of The Word?

1. These (person) ……are protesting against the president.
2. The (woman) …….. over there want to meet the manager.
3. My (child) …… hate eating pasta.
4. I am ill. My (foot) ……. hurt.
5. Muslims sacrifice (sheep)……. in a religious celebration called Eid Al Adha.
6. I clean my (tooth) …….. three times a day.
7. The (student) …….are doing the exercise right now.
8. The (fish)…… I bought is in the fridge.
9. They are sending some (man) …….. to fix the roof.
10. Most (housewife) …….. work more than ten hours a day at home.
11. Where did you put the (knife) …….? On the (shelf) …….
12. (Goose) ……. like water.
13. (Piano) ……are expensive

14. Some (policeman) ……..came to arrest him.

15. Where is my (luggage) ……..? In the car!

Exercise 5: Read the question carefully and choose the right answer (s)

1) - identify the word that is underlined as either an adjective noun or pronoun

- The science book is on the Shelf

  - adjective
  - noun
  - pronoun

2) - choose the right forms of English nouns either singular or plural

- There is one…….. on the floor.

  - Mouse
  - Mice

4) - Decide whether the words in bold are nouns or verbs

They play the "**drums".**

  - Noun
  - Verb

Part II: ORAL COMPREHENSION AND EXPRESSION

2-1 Definition of Oral Expression:

Oral expression is the ability to convey wants, needs, thoughts, and ideas meaningfully usingappropriate syntactic, pragmatic, semantic, and phonological language structures.

Oral language: importance to learning

- Oral language provides the foundations for literacy development; which leads to successin reading and writing.
- Both comprehension and expression are essential to academic achievement in all contentareas
- Communication skills are critical for overall success in any studies

2-2 Paragraph Writing

2-2-1 Definition

A paragraph is a sentence or group of sentences that support one main idea. It is a series of sentences that are organized and coherent, and are all related to a single topic.

In academic writing, a paragraph is often between five and ten sentences long but it can be longeror shorter, depending on the topic [7].

Paragraphs can contain many different kinds of information. A paragraph could contain a seriesof brief examples or a single long illustration of a general point. It might describe a place, character, or process; narrate a series of events; compare or contrast two or more things; classify

items into categories; or describe causes and effects. Regardless of the kind of information they contain, all paragraphs share certain characteristics. One of the most important of these is a topic sentence.

A paragraph has three basic parts: the topic sentence, the supporting sentences, and the concluding sentence.

1. **The topic sentence:** it is the main idea of the paragraph. It is usually the first sentence of theparagraph, and it is the most general sentence of the paragraph.
2. **The supporting sentences:** these are the sentences that talk about or explain the topicsentence. They are more detailed ideas that follow the topic sentence.
3. **The concluding sentence:** this may be found as the last sentence of the paragraph. It can finisha paragraph by repeating the main idea or just giving a final comment about the topic.

2-2-2 Qualities of a Good Paragraph

1. **Unity:** A good paragraph possesses unity when all the sentences develop the main idea. Unity in the paragraph is achieved by the use of a topic sentence with its controlling idea, supporting details, and concluding sentence.

2. **Coherence:** all the sentences and ideas in the paragraph flow smoothly together to make clear and logical points about the topic. Coherence can be achieved through the use of:

   a. Natural or easily recognized order.

   b. Transition words and phrases - used to show the connection from one sentence to another, or tosignal a new train of thoughts.

   c. Repetition of Key Words - important words or phrases (and their synonyms) may be repeated throughout a paragraph to connect the thoughts into a coherent statement.

   3. Order: Order refers to the way you organize your supporting sentences. Whether you choose chronological order, order of importance, or another logical presentation of detail, a solid paragraph always has a definite organization. In a well-ordered paragraph, the reader follows along easily, aided by the pattern you've established. Order helps the reader grasp your meaning and avoid confusion.

4. **Completeness:** Completeness means a paragraph is well-developed. If all sentences clearly and sufficiently support the main idea, then your paragraph is complete. If there are not enough sentences or enough information to prove your thesis, then the paragraph is incomplete. Usually three supporting sentences, in addition to a topic sentence and concluding sentence, are needed for a paragraph to be complete. The concluding sentence or last sentence of the paragraph should summarize your main idea by reinforcing your topic sentence.

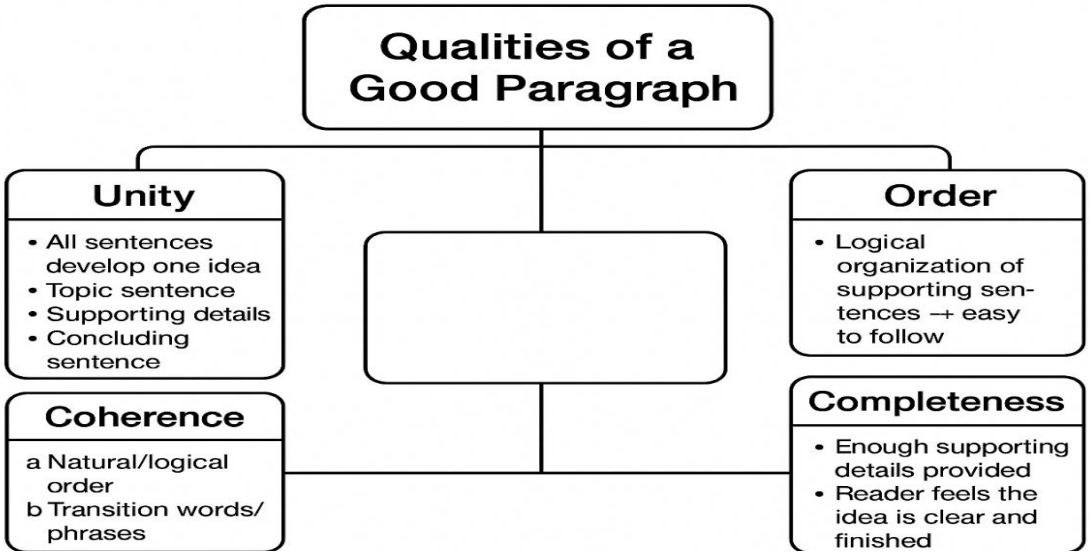


Figure.2: Qualities of a Good Paragraph

2-3 Activities and exercises

Exercise 1: fill in the gaps with the appropriate words from the list: **discipline, solving, minimum, equations, algebraic**

Algebra emerged as a fundamental **…….** focused on problem-solving **……**; patterns, and mathematical relationships. Among its significant developments are methods for **…....** linear and quadratic equations, such as the quadratic formula, factoring techniques, and systems of equations. The discipline encompasses work with variables, polynomials, and functions, including ways to analyze graphs, find roots, and determine maximum and **……** values. A systematic approach to solving complex mathematical problems using symbolic representation and manipulation is credited to Al-Khwarizmi, whose work laid the foundation for modern **……...** notation and methods.

Exercise 2: fill in the gaps with the following words: **produce /steam turbines/ forced / generator / kinetic energy / electricity / mechanical**

Most of the **…….**. in the United States is produced in **…….** A turbine converts the **…….** of a moving fluid (liquid or gas) to **……** energy. Steam turbines have a series of blades mounted on a shaft against which steam is **…….** and the shaft is connected to **…….**. The fuel is burned in a furnace to heat water in a boiler in order**… …….** steam.

COURSE II

USES OF NUMBERS, SYMBOLS, EQUATIONS AND PROCESS MEASUREMENT

COURSE II:

USES OF NUMBERS, SYMBOLS, EQUATIONS AND PROCESS MEASUREMENT

II-1 Math Numbers

a/- Natural numbers: are those used for counting 1,2,3,4, 5,……

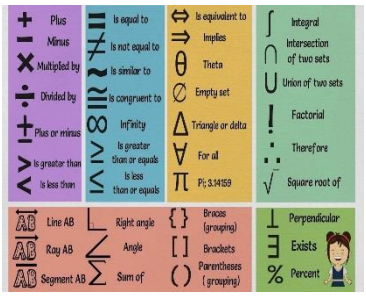
b/- Integers numbers: is a number that can be written without fractional component, e.g 21, 4, 0, - 243

c/- Rational numbers: a rational number is any number that can be expressed as the quotient or fraction x/y of two integers, with the denominator y not equal to zero 2/3, -3, 2.69.

d/- Real numbers: the real numbers include all the rational numbers, such as the integer -4 and the fraction 3/2, and all the irrational numbers $\sqrt{2}$ (1.41421356…, the square root of two, an irrational algebraic number) and π (3.14159265…

e/- complex numbers: A complex number is a number that can be expressed in the form a+ bi, where a and b are real numbers and i is the imaginary unit, which satisfies the equation $i^2 = -1$. In this expression, a is the real part and b is the imaginary part of the complex number

II-2 Math Symbols



Mathematics is about all numbers, symbols and formulas. Mathematics symbols are used from one mathematical field to another for different purposes. Using symbols to represent mathematical information makes it easy to understand manifestations because these symbols show the ratio of quantities. Let's look at ordinary people that we use in different branches of mathematics [8].

a/- Common Math Symbols

We have at least 10,000+ symbols and there are some that we rarely use. The most common symbols are listed in the following table:

Symbols	Meaning	Math Symbols Examples
+	Add	5 + 4 = 9
-	Subtract	5 - 4 = 1
=	Equal to	1+1 = 2
≡	Identically equal to	$(a+b)^2 \equiv a^2 + 2ab + b^2$
≈	Approximately equal to	$\Pi \approx 3.14$
≠	Not equal to	$5 + 4 \neq 1$
×	Multiply	$5 \times 4 = 20$
÷	Divide	$10 \div 2 = 5$
x,y	Variables	x=5, y=2
√	Square root	√4=2
3√x	Cube root of x	3√27=3
n√x	nth root of x	4√16=2
()	Parentheses	2+(5−3) =2+2=4
∈	Belongs to	0 ∈ Whole number
∉	Does not belong to	1/2∉ Natural numbers
∴	Therefore	x+1=2∴ x=1
∵	Because	1/2÷0.5=1(∵1/2=0.5)
∞	Infinity	Infinity is countless, 1/3 when written in decimal form, is endless 0.333.....
!	Factorial	5! =5×4×3×2×1

b/- Math Symbols Used in Logic

The following table shows the math symbols used in logic.

Symbols	Meaning	Math Symbols Examples
∃	There exists at leastone	∃ x: P(x)∃ x: F(x) There exists at least one element of p(x), x,such that F(x) is True.
∃!	There exists one andonly one	∃! x: F(x) Means that there is exactly one x, such that F(x) is true.
∀	For all	∀n>1; n^2>1
¬	Logical Not	Statement A is true only if ¬ is false x≠y ⇔ ¬(x=y)
∨	Logical OR	The statement A ∨ B is trueif A or B is true; If both are false, the statement is false.
∧	Logical And	The statement A ∧ B is true If A and B are both true; else it is false.
⟹	Implies	x = 2 ⟹ $x^2 = 4$
⇔	If and only if	x +1 = y +1 ⇔ x = y

c/- Geometry and Algebra Symbols

The table given below shows the commonly used geometrical symbols. The mathematical symbols with names and examples are also listed in the table

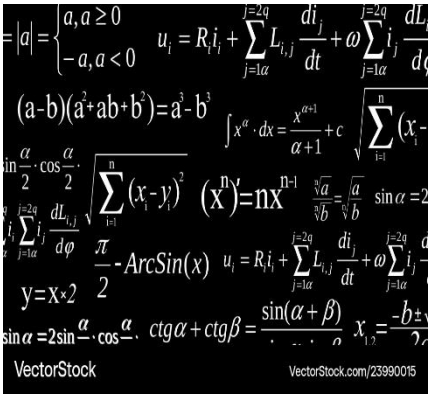
Symbols	Meaning	Math Symbols Examples
∠	Mention the angle	∠ABC∠
Δ	Triangle symbol	ΔPQR
≅	Congruent to	ΔPQR≅ΔABC
~	Similar to	ΔPQR~ΔABC
⊥	Is perpendicular with	AB ⊥ PQ
‖	Is parallel with	AB ‖ CD
∘	Degree	60∘
$\overline{\quad\quad}$AB	Line segment AB	A line from Point A to Point B
⟌AB	Ray AB	A line starting from Point A and extends through B
↔AB	Line AB	An infinite line passing through points Aand B

d/- Greek Alphabets and Combinatory Symbols

The table below shows the Greek alphabets that are used as mathematical symbols. Their names, usage, and example are also listed in the table [8].

Symbols	Meaning	Math Symbols Examples
Α	Alpha	Used to denote angles, coefficients
Β	Beta	Used to denote angles, coefficients
Γ	Gamma	Used to denote angles, coefficients
Δ	Delta	Discriminant symbol
Ε	Epsilon	Used to represent Universal Set
Λ	Lambda	Represents constant
Π	Pi	π≈3.14
Σ	Sigma	Represents the sum
Θ	Theta	Represents angles
Ρ	Rho	Statistical constant
Φ	Phi	Diameter symbol

II-3- Math Equations



Mathematical equations can present difficult and costly problems of type composition.Because equations often must be retyped and reformatted during composition, errors can be introduced. Keep in mind that typesetters will reproduce what they see rather than what the equation should look like. Therefore, preparation of the manuscript copies and all directions and identification of letters and symbols must be clear, so that those lacking in mathematical expertise can follow the copy [9].

- An equation can use any combination of mathematical operations, including addition, subtraction, division, or multiplication.

a/- Linear Equation: equation of line (slope and intercept form), is a straight line onthe coordinate plane can be described by the equation ***y=ax+ b***

Where: **a** is the slope of the line and **b** is the intercept

b/- Nonlinear equation: equation whose graph does not form a straight line (linear)

E.g: $6x^2+3y-1=0$

c/- Integrals, Summations, and Limits

With single integral signs, the upper and lower limits should always be placed to the right of the integral sign, never above and below. In text, this can be accomplished by stacking supers And subs $\int_{\infty}^{0} f$ For summations, the limits above and below are customary in display equations; in text, however, and in the numerator and/or denominator of display equations, the right-side position is required.

d/- Roots

As practical, use negative exponents or the solidus instead of display fractions and fractional powers instead of the radical sign. For example,

$$\frac{\cos\frac{1}{x}}{\sqrt{a}+\frac{b}{x}}$$

is better written as

$$\frac{\cos\ (1/x\ )}{[a\ +(b\ /x\ )]^{1/2}}$$

Nonetheless, considerations of space should not override clarity. The previous equation can be further condensed to fit within the text line as $[\cos(1/x)]/\ \{[a\ +\ (b/x)]_{1/2}\}$, but this is not necessarily the best presentation.

e/- Exponential Functions:

For lengthy or complex exponents, the symbol exp is preferred, particularly if such exponentials appear in the body of the text. Thus, exp $(a^2 + b^2)^{1/2}$ is preferable to $e^{(a2\ +\ b2)1/2}$. The larger size of symbols permitted by this usage also makes reading easier.

II-4- Measures:

II-4-1- Measurement

Is the process of attaching a numeric value to an aspect of natural phenomenon, such as the volume of the milk produced by a goat?

To begin the process of measurement, we need to recognize the type of phenomenon, called the **physical dimension** that we would like to measure. For example, the diameter of the front wheel of a bicycle is of type **Length,** how fast the bicycle is moving is described by **Speed** and the amount of air crammed inside the wheel is determined by **Pressure** [10].

II-4-2- Standardization of measurement units

Standardization of measurement units refers to the process of establishing and using a universally accepted system for science, engineering science, business and everyday life. The most accepted system today is the international system of devices (SI), which is built on seven original or base units: **kilos, meters, other, amps, kelvin, Candela and mole**. These base units act as the basis for defining all other derived devices (for example, Newton for Force, Joule for Energy and Pascal for Pressure) [10].

The purpose of standardization is to ensure that measurements are accurate, consistent and comparable worldwide, and prevent confusion that can arise from using different local or traditional measuring systems. By using standardized units, researchers and engineers can

reproduce experiments with credibility, linked to proper trade in business boundaries and ensure safety and clarity in social communication.

In addition, the SI system is continuously maintained and updated by international organizations such as Bureau International des Poids at Messrs (BIPM), which ensures that the definitions of units are based on the universal constants of nature (eg the speed of light, Planck's constant), making them more precise and independent of physical artifacts [11].

Base quantity	**Base.unit**	**Symbol**	**Current SI constants**
Time	Second	S	Hyperfine splitting in Cesium-133
Length	Meter	M	Speed of light in vacuum, c
Mass	Kilogram	Kg	Mass of international prototype kilogram (IPK)
Electric current	Ampere	A	Permeability of free space, permittivity of free space
Temperature	Kelvin	K	Triple point of water, absolute zero
Amount substance	Mole	Mol	Molar mass of carbon -12
Luminous intensity	Candela	Cd	Luminous efficacy of 540 THz source

a/- Length: the distance from one end of something to the other end: a measurement of how long something is. The units are: meter, centimeter, pond, inch……

b/- Surface: a surface is a set of points on which it is possible to identify locally using two real coordinates, as in the plane (with x and y coordinates). The unit is m^2 or cm^2……

c/- Volume: the volume, physical science or mathematics, is a quantity that measures the extension of an object or part of the space. The volume unit is M^3, L

d/- Power: We can define power as the rate of doing work, it is the work done in unit time. The SI unit of power is Watt (W) which is joules per second (J/s). Sometimes the power of motor vehicles and other machines is given in terms of Horsepower (hp), which is approximately equal to 745.7 watts [10].

II-5 Activities and exercises

Exercise 1: write the equation on alphabets (letters):

8 - 5 = 3:

15 ÷ 3 = 5:

3 + 4 = 7:

$\sqrt{16} = 4$:

$-2.3 \cdot 10^6$:

$x^2 - 3y = -4$:

Exercise 2: write the equation by variables and symbols

	Three sevenths
	X plus y all cubed
	X is less than or equal to y
	The cube root of x

Exercise 3: Write each of the following word problems as an equation, then solve:

a) Sarah has 8 apples. She buys 5 more. How many apples does she have now?

b) A box contains pencils. If 12 pencils are taken out and 18 remain, how many pencils were in the box originally?

c) Twice a number plus 3 equals 15. Find the number.

COURSE III

DESCRIBE A SCIENTIFIC EXPERIMENT IN THE FIELD OF ELECTRICAL ENGINEERING

COURSE III
DESCRIBE A SCIENTIFIC EXPERIMENT IN THE FIELD OF ELECTRICAL ENGINEERING

III-1 definition of a scientific experiment

A scientific experiment is any process in which measurements are used and tests are carried out to verify or refuse a hypothesis. The hypothesis is a proposition that appears to be true, but has not yet been corroborated, and from which an investigation can be developed. Its objective is to increase the data we know about nature [12].

The scientific experiment belongs to a whole process known as the **scientific method**. This method is a set of ordered steps used to acquire new knowledge on any subject. Their steps are:

1. Making an observation.
2. Asking a question and formulating a hypothesis.
3. Scientific experiments to test the hypothesis and collect data.
4. Examining the results and drawing conclusions.
5. Reporting the results.

III-2 Main types of scientific experiment

The three main types of scientific experiments are experimental, quasi-experimental, and observational (non-experimental)

– **Experimental**: or randomized control, is the highest level of scientific experimentation. In this form of scientific experiment, at least two groups are used.

- Quasi-experimental: is the second type of scientific experiment. Its goal is to prove that an independent and dependent variable have a cause-and-effect connection. A quasi-experiment, unlike a true experiment, does not rely on random assignment. Subjects are instead divided into groups depending on non-random factors. In circumstances where true experiments are not possible due to ethical or practical considerations, quasi-experimental design is a useful technique [12].

- Non-experimental: research is study in which no independent variable is manipulated. Non-experimental researchers just measure variables as they naturally occur rather than influencing an independent variable (in the labor real world). Non-experimental research is preferred in a variety of situations.

III-3 Examples of scientific experiment

If there is one thing that is guaranteed to get your students excited, it's a good science experiment! While some experiments require expensive lab equipment or dangerous chemicals, there are plenty of cool projects you can do with regular household items. We've rounded up a big collection of easy science experiments that anybody can try, and kids are going to love them!

1. **Amplify a smartphone**

No Bluetooth speaker? No problem! Put together your own from paper cups and toilet paper tubes.

2. Watch the water rise

Learn about Charles's Law with this simple experiment. As the candle burns, using up oxygen and heating the air in the glass, the water rises as if by magic

3. Set raisins dancing

This is a fun version of the classic baking soda and vinegar experiment, perfect for the younger crowd. The bubbly mixture causes raisins to dance around in the water.

4. Race a balloon-powered car

Kids will be amazed when they learn they can put together this awesome racer using cardboard and bottle-cap wheels. The balloon-powered "engine" is so much fun too.

5. Make elephant-sized toothpaste

This fun project uses yeast and a hydrogen peroxide solution to create overflowing "elephant toothpaste." You can also add an extra fun layer by having the kids create toothpaste wrappers for their plastic bottles

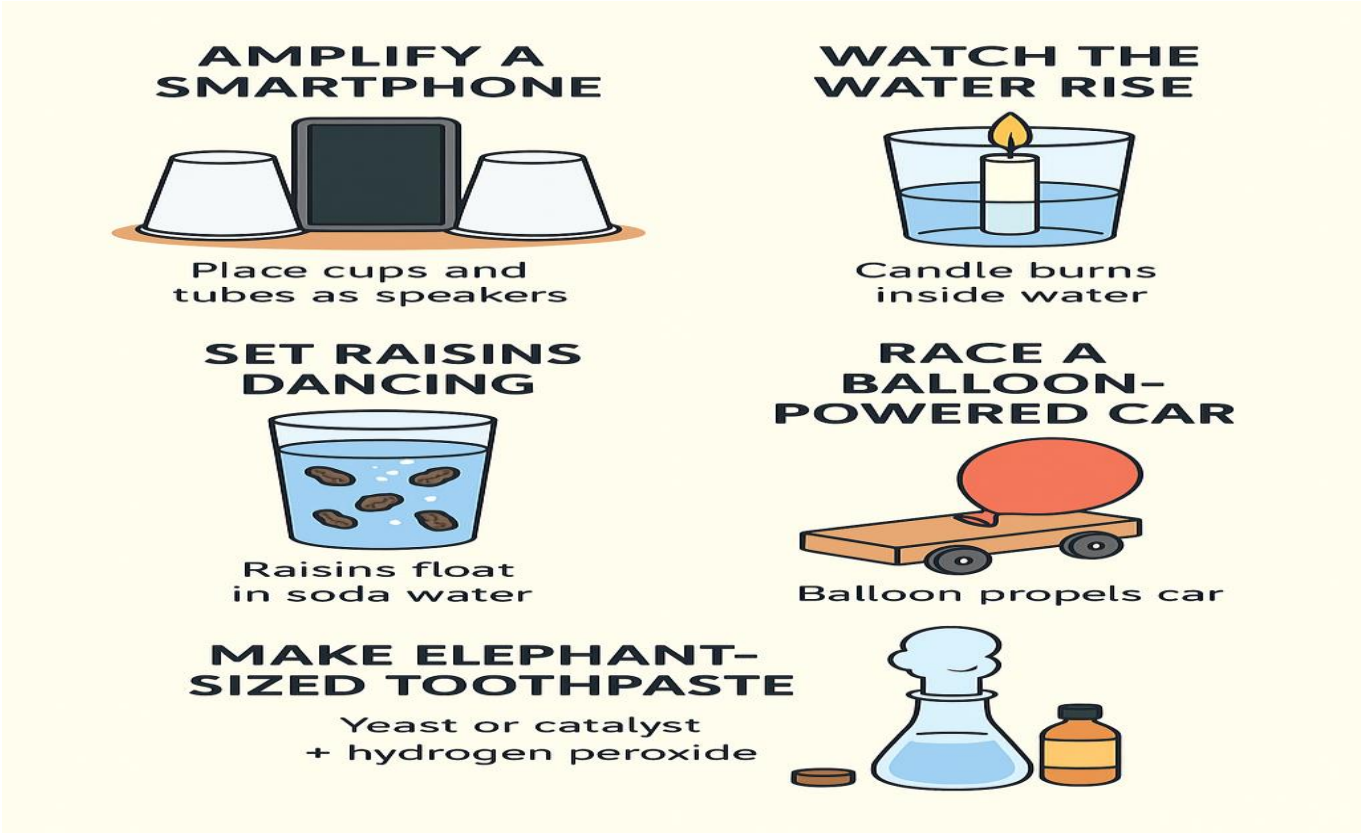


Figure.3: Examples of scientific experiment

III-4 Electrical engineering definition

a) - Engineering: is the designing, testing and building of machines, structures and processes using math and science. Studying it can lead to a rewarding career. Engineering is a discipline dedicated to problem solving

b) - Electrical engineering is a section of physics that deals with the field of electricity and its applications. It brings together the fields of electro technical engineering and electronic engineering. The domain study is carried out in physics; the application is done in the industrial domain.

III-5 Best Electrical Engineering Specializations, Devices and Tools

Electrical equipment depends on electrical energy (AC or DC) to provide power to the main parts (electric motors, transformers, lighting, recommended batteries and control electronics). They can be compared to traditional mechanical devices that depend on various energy sources, such as fuel or human physical strength. Electronic devices are a special type of electrical unit, where electrical energy is mainly used for data processing instead of generations of mechanical forces. To separate the two classes, the electrical equipment that emphasizes physical work is also called

electromechanical. Mechatronics pronounces the intersection of two regions. Together, electronic and electrical devices make their development, maintenance and power supply for electrical engineering. [13].

With the advancement in technology, many **electrical engineering specialization fields** have been developed in recent years. This demand is growing in all areas all over the world.

III-5-1 Power and energy

Power and energy technology is related to the design of a series of related equipment along with the generation, transmission and distribution of electricity. These include transformers, electrical generators, electric motors, and high voltage technique and power electronics. Power engineers can also work with the power system together with the design and maintenance of the power grid. Such systems are called on grid power systems and can supply networks with extra power, attract electricity from the grid, or both can. Power engineers can also work with systems that are not connected to the network, called off-networks or off-grid, which is better for network systems in some cases [14].

- ***Their devices and tools***

- **Electricity generation** is the process of generating electric power from sources of primary energy. For utilities in the electric power industry, it is the stage prior to its delivery (transmission, distribution, etc.) to end users or its storage

- **Electric power transmission** is the bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation. The interconnected lines that facilitate this movement form a *transmission network*

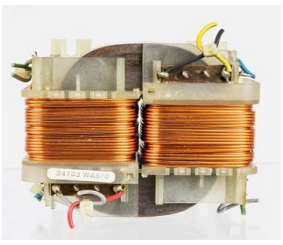
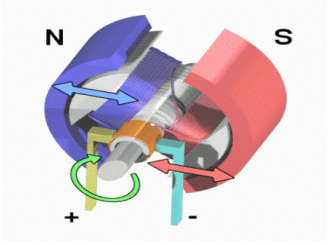
- **Electric power distribution** is the final stage in the delivery of electricity. Electricity is carried from the transmission system to individual consumers.

- **A transformer** is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits

- **An electric motor** is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current

- **An electrical grid** is an interconnected network for electricity delivery from producers to consumers. Electrical grids vary in size and can cover whole countries or continents.



Generation **Transmission** **Transformers** **Electric motors**

Figure.4: Tools and equipment used in Power and energy specialties

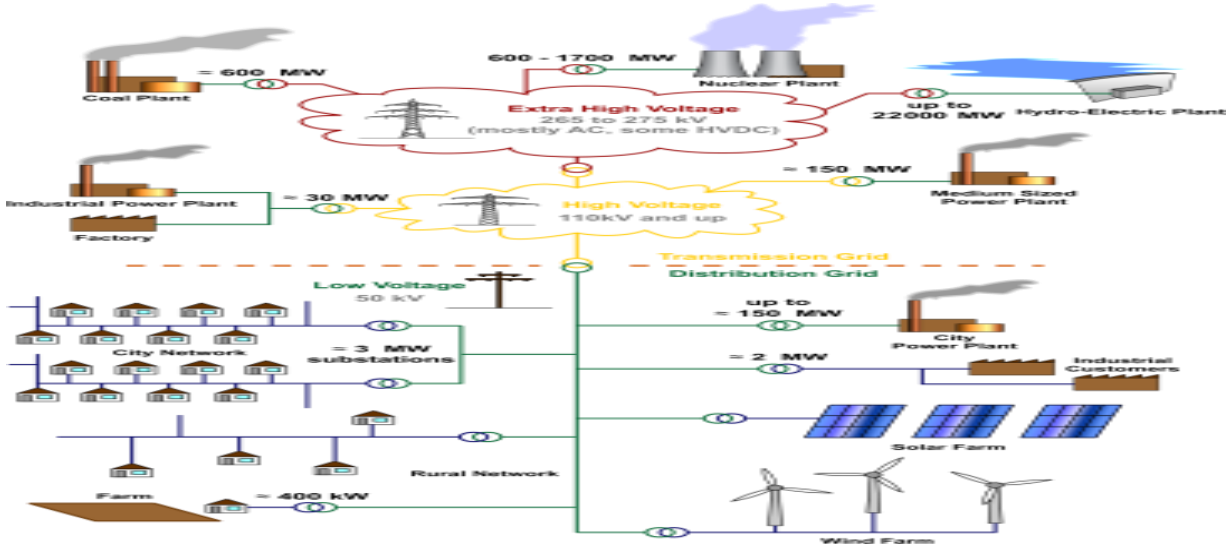


Figure.5: Power grid

III-5-2 Telecommunications

Communications engineering focuses on transmitting information over a communication channel such as coaxial cable, optical fiber, or free space. Free-space transmissions require encoding information into a carrier signal to convert the information to a carrier frequency suitable for transmission; this is known as modification. Common analog modulation techniques include amplitude modulation and frequency modulation. The choice of modification affects the cost and performance of the system and the engineer must carefully balance these two factors [15].

Once the transmission characteristics of a system are determined, communications engineers design the necessary transmitters and receivers for those systems. These two are sometimes combined to form a two-way communication device known as a transceiver. A key consideration in the design of transmitters is their power consumption as this is closely related to signal strength. Normally, if the strength of the transmitted signal is insufficient once the signal reaches the receiver's antenna(s), the information in the signal will be corrupted by noise, especially static data.

- ***Their devices and tools***

- **transmission** is the process of sending or propagating an analog or digital signal via a medium that is wired, wireless, or fiber-optic

- **Coaxial cable**, or **coax** ,is a type of electrical cable consisting of an inner conductor surrounded by a concentric conducting shield, with the two separated by a dielectric.

- **Free-space optical communication** (**FSO**) is an optical communication technology that uses light propagating in free space to wirelessly transmit data for telecommunications or computer networking.

- **Arrier wave**, **carrier signal**, or just **carrier**, is a waveform (usually sinusoidal) that is modulated (modified) with an information-bearing signal (called the *message signal* or *modulation signal*) for the purpose of conveying information.

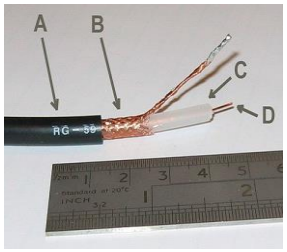
- **Amplitude modulation** (**AM**) is a modulation technique used in electronic communication, most commonly for transmitting messages with a radio wave.

- **Frequency modulation** (**FM**) is the encoding of information in a carrier wave by varying the instantaneous frequency of the wave. The technology is used in telecommunications, radio broadcasting and signal processing and computing.

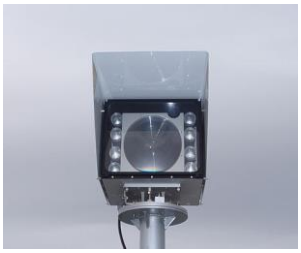
- **Signal strength** refers to the transmitter power output as received by a reference antenna at a distance from the transmitting antenna.

- **Noise** is an unwanted disturbance in an electrical signal.

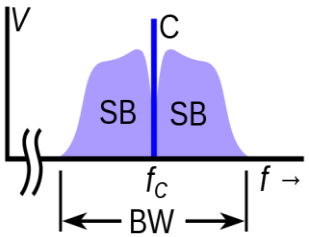
Transmition



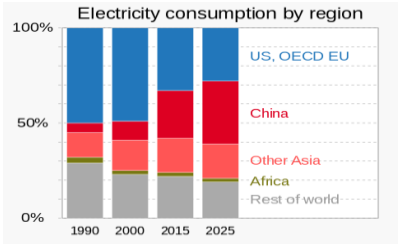
Coaxial cable

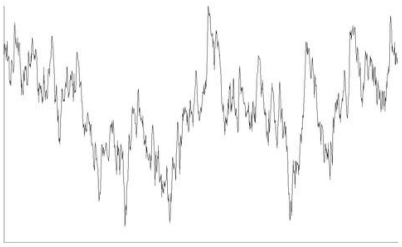


Free space



Carrier signal





Transmitters **Consumption** **Noise**

Figure.6: Tools and equipment used in Telecommunication specialties

III-5-3 Electronics

Electronic engineering involves designing and testing electronic circuits that use the properties of components such as resistors, capacitors, inductors, diodes, and transistors to achieve a specific function. The tuned circuit, which allows the radio user to filter out all but one station, is just one example of such a circuit. Another example of research is a pneumatic signal conditioner [16].

Before World War II, this subject was known as radio engineering and was mainly limited to aspects of communications, radar, commercial radio and early television. Later, in the postwar years, as consumer appliances began to be developed, the field grew to include modern television, audio systems, computers, and microprocessors. In the mid-to-late 1950s, the term radio engineering gradually gave way to the name electronic engineering.

- ***Their devices and tools***

- **An electronic circuit** is composed of individual electronic components, such as resistors, transistors, capacitors, inductors and diodes, connected by conductive wires or traces through which electric current can flow.

- **A resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

- **A capacitor** is an electronic device that stores electrical energy in an electric field by accumulating electric charges on two closely spaced surfaces that are insulated from each other. It is a passive electronic component with two terminals.

- **An inductor**, also called a **coil**, **choke**, or **reactor**, is a passive two-terminal electrical component that stores energy in a magnetic field when electric current flows through it. An inductor typically consists of an insulated wire wound into a coil.

- A **diode** is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance). It has low (ideally zero) resistance in one direction and high (ideally infinite) resistance in the other.

- A **transistor** is a semiconductor device used to amplify or switch electrical signals and power. It is one of the basic building blocks of modern electronics

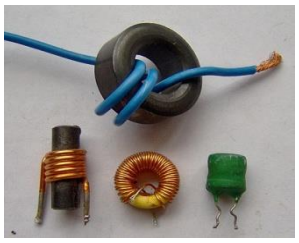
- An **LC circuit**, also called a **resonant circuit**, **tank circuit**, or **tuned circuit**, is an electric circuit consisting of an inductor, represented by the letter L, and a capacitor, represented by the letter C, connected together. The circuit can act as an electrical resonator, an electrical analogue of a tuning fork, storing energy oscillating at the circuit's resonant frequency.

- **Electronic filters** are a type of signal processing filter in the form of electrical circuits. This article covers those filters consisting of lumped electronic components, as opposed to distributed-element filters.

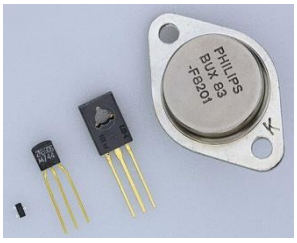
- **A microprocessor** is a computer processor where the data processing logic and control is included on a single integrated circuit (IC), or a small number of ICs. The microprocessor contains the arithmetic, logic, and control circuitry required to perform the functions of a computer's central processing unit (CPU).

Resistors

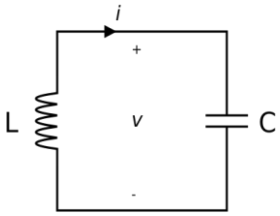
Capacitors



Inductors

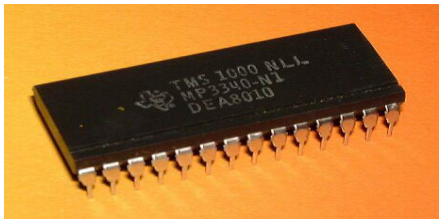


Transistors



Tuned circuit

Filter



Microprocessor

Figure.7: Tools and equipment used in Electronics specialties

III-5-4 Control engineering and automatic

Control engineering focuses on modeling a variety of dynamic systems and designing controllers that will make these systems behave in the desired way. To implement these controllers; electronic control engineers may use electronic circuits, digital signal processors, microcontrollers, and programmable logic controllers (PLCs). It has a wide range of applications from the flight and propulsion systems of commercial aircraft to the cruise control found in many modern automobiles. It also plays an important role in industrial automation [17].

Control engineers also work in robotics to design autonomous systems using control algorithms that interpret sensory feedback to control motors that move robots such as autonomous vehicles, drones, and others used in a variety of industries.

- ***Their devices and tools***

- **A digital signal processor** (**DSP**) is a specialized microprocessor chip, with its architecture optimized for the operational needs of digital signal processing. DSPs are fabricated on MOS integrated circuit chips.

- A **microcontroller** (**MC**, **UC**, or **µC**) or **microcontroller unit** (**MCU**) is a small computer on a single integrated circuit. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

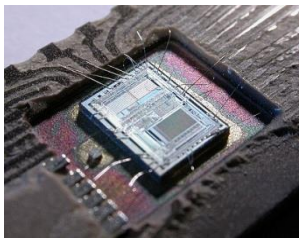
- **A programmable logic controller** (**PLC**) or **programmable controller** is an industrial computer that has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, machines, robotic devices.

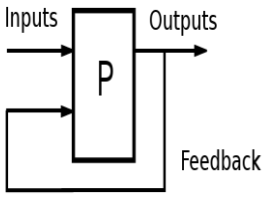
- **Cruise control** (also known as **speed control**, **cruise command**, **autocruise**, or **tempomat**) is a system that automatically controls the speed of an automobile. The system is a servomechanism that takes over the throttle of the car to maintain a steady speed as set by the driver.

- **Feedback** occurs when outputs of a system are routed back as inputs as part of a chain of cause-and-effect that forms a circuit or loop. The system can then be said to *feed back* into itself.

- **Robotics** is an interdisciplinary field that involves the design, construction, operation, and use of robots.

- **Vehicular automation** involves the use of mechatronics, artificial intelligence, and multi-agent systems to assist the operator of a vehicle such as a car, lorries, aircraft, or watercraft



Digital signal processors **Microcontrollers** **PLCs** **Feedback**

Figure.8: Tools and equipment used in Control engineering and automatic specialties

III-5-5 Electrotechnics and Instrumentation engineering

Instrumentation engineering deals with the design of devices to measure physical quantities such as pressure, flow, and temperature. Designing such instruments requires a good understanding of physics, which often extends beyond electromagnetic theory. For example, flight instruments measure variables such as wind speed and altitude to enable pilots to control the aircraft analytically. Often the devices are not used per se, but instead as sensors for larger electrical systems [18].

- ***Their devices and tools***

- **Pressure** (symbol: *p* or *P*) is the force applied perpendicular to the surface of an object per unit area over which that force is distributed. Gauge pressure (also spelled *gage* pressure) is the pressure relative to the ambient pressure.

- **Electromagnetism** is an interaction that occurs between particles with electric charge via electromagnetic fields. The electromagnetic force is one of the four fundamental forces of nature.

- **Flight instruments** are the instruments in the cockpit of an aircraft that provide the pilot with data about the flight situation of that aircraft, such as altitude, airspeed, vertical speed, heading and much more other crucial information in flight.

- **Wind flow speed :** is a fundamental atmospheric quantity caused by air moving from high to low pressure, usually due to changes in temperature. Wind speed is now commonly measured with an anemometer.

- **A thermocouple**, also known as a "thermo electrical thermometer", is an electrical device consisting of two dissimilar electrical conductors forming an electrical junction.

- **A sensor** is a device that produces an output signal for the purpose of sensing a physical phenomenon.

Flow **Flight instruments** **thermocouple** **Sensors**

Figure.9: Tools and equipment used in Electrotechnics and Instrumentation engineering specialties

III-6 Renewable Energy Power Revolution: Latest Trends in Electrical Engineering

Electrical engineers must address growing problems in the smart and sustainable energy sectors. There is the role of renewable energy, which helps produce electricity in a better way. Renewable energy is becoming more and more in demand all over the world. As opposed to non-renewable energy sources like coal, oil, or gas, its abundant natural availability and lower emissions of carbon and other pollutants are the primary reasons. Renewable energy comes from processes or natural resources that are constantly replenished. Hydro, biomass, geothermal, and wave energy are the other types of renewable energy [19].

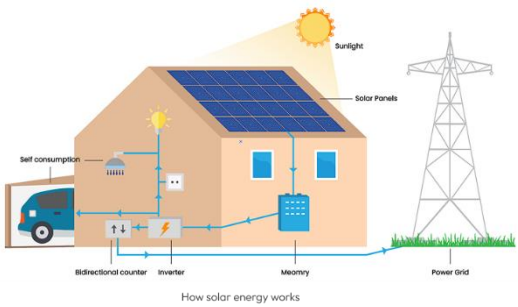
Renewable is becoming a more significant power source. From residential rooftop solar panels to enormous offshore wind farms, the growth of renewable energy is also taking place on both large and small scales. Heating and lighting are both provided by renewable sources in some rural communities.

III-6-1 What Is Renewable Energy?

Renewable energy is energy that has been derived from earth's natural resources that are not finite or exhaustible, such as wind and sunlight. Renewable energy is an alternative to the traditional energy that relies on fossil fuels, and it tends to be much less harmful to the environment [19].

III-6-2 Types of Renewable Energy

- ***Solar energy***



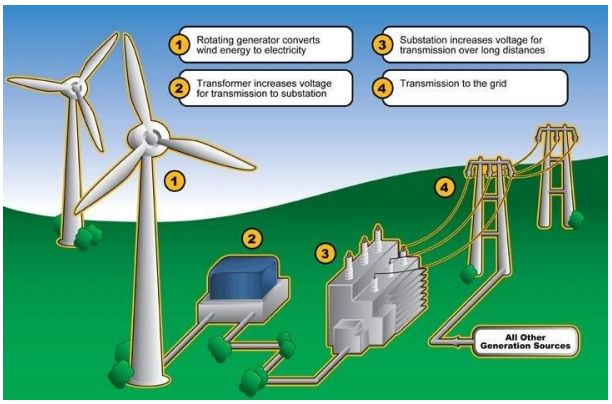
How solar energy works

Solar energy is derived by capturing radiant energy from sunlight and converting it into heat, electricity, or hot water. Photovoltaic (PV) systems can convert direct sunlight into electricity through the use of solar cells.

Solar technologies are used by industries and businesses to save money, increase efficiency, and diver-

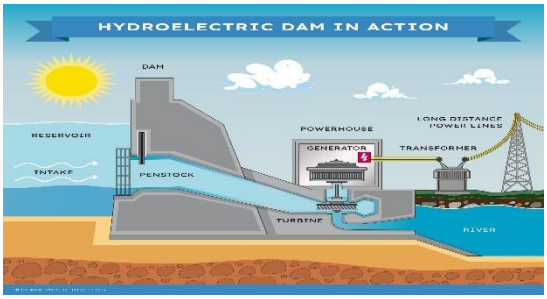
sify their energy sources. Solar photovoltaic and solar power technologies are utilized by energy developers and utilities to produce electricity on a massive scale. The electricity grid is being modernized by renewable energy, making it smarter, safer, and interconnected across regions [20].

- ***Wind energy***



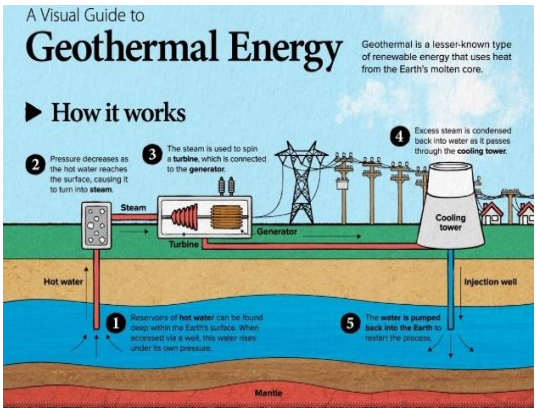
Wind farms capture the energy of wind flow by using turbines and converting it into electricity. There are several forms of systems used to convert wind energy and each vary. Commercial grade wind-powered generating systems can power many different organizations, while single-wind turbines are used to help supplement pre-existing energy organizations. Another form is utility-scale wind farms, which are purchased by contract or wholesale. Technically, wind energy is a form of solar energy. The phenomenon we call "wind" is caused by the differences in temperature in the atmosphere combined with the rotation of Earth and the geography of the planet. [20]

- ***Hydroelectric energy***



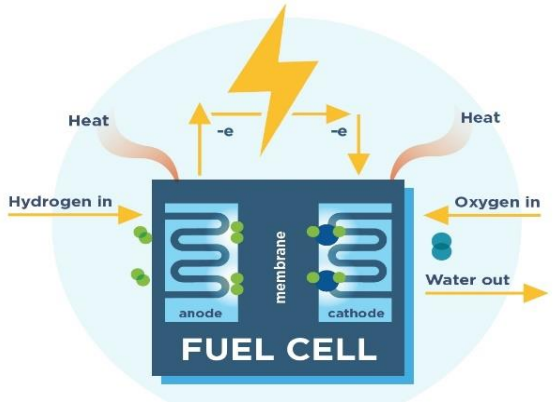
Dams are what people most associate when it comes to hydroelectric power. Water flows through the dam's turbines to produce electricity, known as pumped-storage hydropower. Run-of-river hydropower uses a channel to funnel water through rather than powering it through a dam [20].

- ***Geothermal energy***



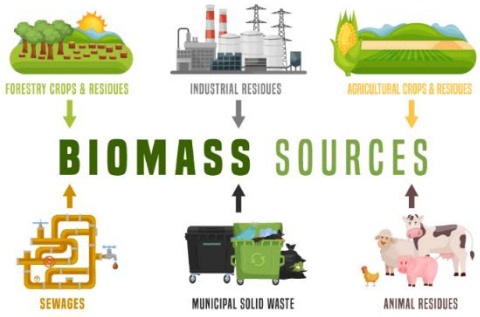
Geothermal heat is heat that is trapped beneath the earth's crust from the formation of the Earth 4.5 billion years ago and from radioactive decay. Sometimes large amounts of this heat escapes naturally, but all at once, resulting in familiar occurrences, such as volcanic eruptions and geysers. This heat can be captured and used to produce geothermal energy by using steam that comes from the heated water pumping below the surface, which then rises to the top and can be used to operate a turbine [20].

- ***Hydrogen and fuel cells energy***



Hydrogen needs to be combined with other elements, such as oxygen to make water as it does not occur naturally as a gas on its own. When hydrogen is separated from another element it can be used for both fuel and electricity [20].

- ***Biomass energy***



Bio-energy is a renewable energy derived from biomass. Biomass is organic matter that comes from recently living plants and organisms. Using wood in your fireplace is an example of biomass that most people are familiar with [20].

Figure.10: Department of Electric Power Engineering

III-6-3 Most Energy Power Trends in Electrical Engineering

1. The transmission of electrical energy without the use of connecting wires from a power source to a receiver is referred to as wireless power transfer (WPT) or wireless energy transfer. For energy transmission, WPT systems make use of time-varying electromagnetic fields. Heart pumps, security software, and electric vehicle charging docks have all been mentioned as possible applications for wireless power transfer.
2. Smart grids and micro grids promise a better and more cost-effective approach to power generation, in line with current industry trends [21].

- In order to better manage the delivery of electricity and respond to shifting demand, smart grids use two-way communication between the utility and the customer. In addition, renewable energy sources and storage technologies can benefit from this development in electrical engineering. Customers can sell excess current and generate their own power with smart grids.
- A micro grid is a single, controllable entity with respect to the grid made up of interconnected loads and distributed energy resources. On the other hand, to lay it more plainly, micro grids are independent power sources that give capacity to more modest, local area-based regions. Micro grids permit networks to create power nearby when they need it. The current infrastructure for the delivery of electricity could be altered by this trend in power generation.

Figure.11: Smart Grid Requires Re-engineering of the Electricity Industry

3. The electrical design of electric vehicles follows a trend that keeps gaining popularity among consumers. Electric vehicles are becoming increasingly common. Even though charging infrastructure needs to be built, many electric vehicle owners can find charging stations that are easy to get to in many

places. Wireless charging will soon be a standard feature on electric vehicles. Drivers can park their cars in a wireless charging location without the requirement for an external connection, in place of huge charging docks. Engineers are able to achieve their full potential by comprehending and analyzing current and future trends. The future is far more fascinating, innovative, and competitive; electrical engineers at Top Engineering College in Coimbatore have a lot on their desks today and will have a lot more in the future.

III-7 Activities and exercises

***Exercise 1*:** Read the question carefully and choose the right answer (s)

1)-"**Solar energy**" it's a source of renewable energy and it is a radiant light and heat form:

- soil
- Sun
- Wind

2) - A scalar quantity that refers to how "**fast an object is moving"** is:

- Speed
- Temperature
- Weights

3) – A measure of the amount of matter in an object. It is usually measured in grams (g) or kilograms (kg)

- kinetic energy
- Gravity
- Mass

4) - A flow of negatively charged electrons from atom to Atom through a conductor in an electrical circuit is called:

- A magnetic
- A current
- A charge

5) – A fluid matter having no fixed shape but a fixed volume is defined as:

- A solid
- A liquid

6) - cables consistent of several copper wires each with a shield are known as..…….. cables

- Power cables
- Twisted pairs
- Optical fiber

7) - the part of computer which interprets and carriers out instruction is a central……..

- Information
- Processing unit
- Card

Exercise 2: translate these terms into French or Arabic

- Gas engine=
- Machine tool=
- Pump=
- An electric motor =
- A transformer =
- Arrier wave =
- Frequency modulation=
- An electronic circuit=
- A capacitor =
- Digital signal processors=
- A sensor =
- Pressure=
- Wind energy=
- Hydroelectric energy=
- Geothermal energy=

Exercise 3: give some devices and tools of each electrical engineering specialties:

- Power and energy:

- Telecommunications :

- Electronics:

- Control engineering and automatic:

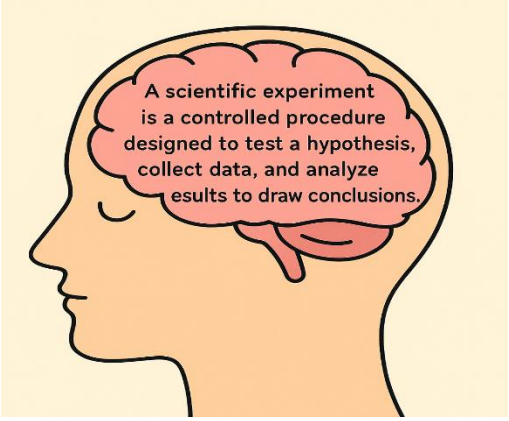
- Electro technical and Instrumentation engineering:

COURSE IV

CHARACTERISTICS OF SCIENTIFIC TEXT

COURSE IV
CHARACTERISTICS OF SCIENTIFIC TEXT

IV-1 What are scientific texts?



A scientific text is one that disseminates the results and findings of an investigation and represents a contribution or novelty for the subject. The author must be a researcher who addresses a specialized audience (such as the scientific community), so they can use technical and formal language.

A scientific text differs from a *popular science article* in that the latter has the purpose of adapting specialized knowledge and technical language, so that they can be understood by the general public that is not an expert on the subject. The scientific text, on the other hand, is not addressed to the general public but rather to an expert or knowledgeable reader on the subject [22].

IV-2 Characteristics of good scientific writing

Good scientific writing is [22]:

A/ Clear: it avoids unnecessary detail;

B/ Simple: it uses direct language, avoiding vague or complicated sentences. Technical terms and jargon are used only when they are necessary for accuracy;

C/ Impartial: it avoids making assumptions (Everyone knows that ...) and unproven statements (It can never be proved that ...). It presents how and where data were collected and supports its conclusions with evidence;

D/ Structured logically: ideas and processes are expressed in a logical order. The text is divided into sections with clear headings;

E/ Accurate: it avoids vague and ambiguous language such as about, approximately, almost;

F/ Objective: statements and ideas are supported by appropriate evidence that demonstrates how conclusions have been drawn as well as acknowledging the work of others.

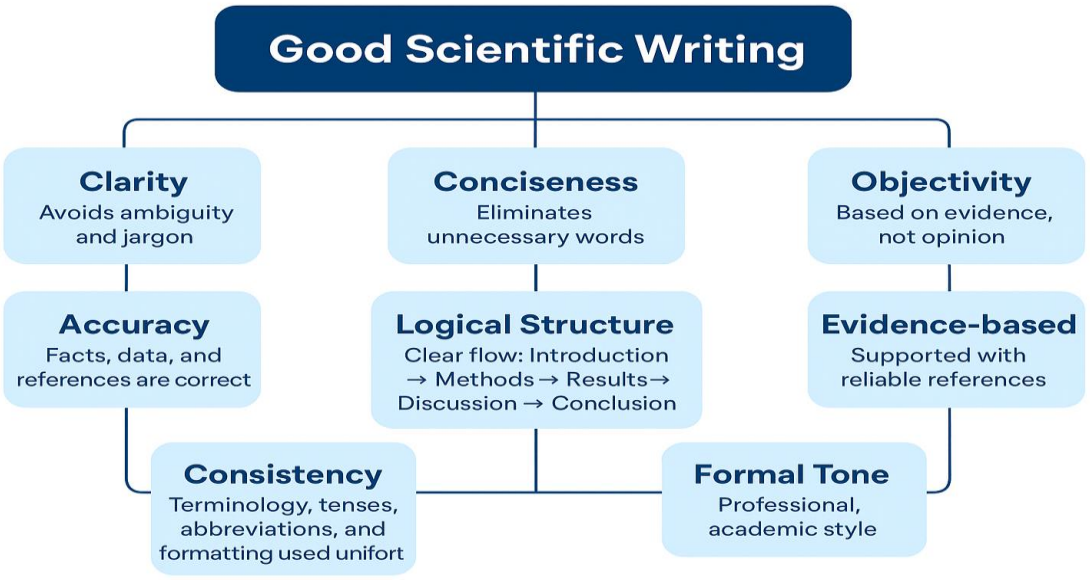


Figure.12: Characteristics of good scientific writing

IV-3 Structure of a scientific text

A scientific text is prepared using the following structure [23]:

- **A defined goal:** The reason why a topic is exposed through a scientific article must be clear and specific. The purpose of the article should be to communicate a new contribution or discovery.
- **A title:** The objective of the topic to be presented must be included in the headline, which must be written in English and in the language of the author (in case it differs).
- **The publication magazine:** The name and publication data of the specialized journal in which the article was previously published must be mentioned after the headline.
- **The author's name:** The author(s) and potential contributors should be listed below the editorial publication details.
- **The summary:** The synthesis of the article must be explained both in English and in the author's language and must mention the objectives, methods used for the investigation, results and conclusion.
- **The keywords:** The summary ends with some words that work as guides to quickly and clearly deduce the essential points of the investigation.
- **The body of the article:** The development of the text consists of the complete detail organized in parts, such as the introduction, the development of the methods applied in the investigation (includes the use of graphs and tables), the results and the conclusion [23].

- **The sources:** Both the bibliography and the other specialized resources that were consulted for the research should be cited at the end of the article.

IV-4 Importance of scientific endorsement

Scientific texts are important to endorse and disseminate research carried out by specialists. A scientific text that achieved dissemination previously had to go through exhaustive review methods through different scientific committees.

The media that communicate a scientific text endorsed by a committee must not be susceptible to any type of manipulation, such as alluding to personal opinions or partially communicating the results of the investigations. The purpose of the evidence disseminated must be to reveal the truth and not to justify an investigator, sponsor or State [23].

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IV-5 Summarizing a Scientific Text

Summarizing a short scientific text in **one paragraph:**

A summary is a shortened version of a longer piece of writing. It captures all the most important parts (main ideas) of the original, but expresses them in a shorter way. Then, it should be expressed--as far as possible--in your own words [24].

To have a coherent summary of a scientific text, you should follow some reading strategies;

Reading strategies:

- Read the original **quickly**, and try to understand its main subject or purpose.
- Read it **again** to understand it in more detail, identify **keywords** and highlight the essential information.
- Look up any **technical words** or concepts you don't know.

After a good reading, you should then:

A/ Identifying the main sections:

- Work through the text to identify its main sections. A main section can be made up of one or various paragraphs. (Number each different section.)
- Write a one or two-sentence account of each section you identify.
- Focus your attention on the main point and leave out any illustrative examples.

B/ The starting point:

- Write a sentence which states the central idea of the original text.
- Complete the paragraph by including one or two sentences per main point or important part.

IV-6 Writing a Scientific Paper

When you write about scientific topics to specialists in a particular scientific field, we call that scientific writing. (When you write to non-specialists about scientific topics, we call that science writing.)

The scientific paper has developed over the past three centuries into a tool to communicate the results of scientific inquiry. The main audience for scientific papers is extremely specialized. The purpose of these papers is twofold: to present information so that it is easy to retrieve, and to present enough information that the reader can duplicate the scientific study [25]. A standard format with six main parts helps readers to find expected information and analysis:

- **Title**: subject and what aspect of the subject was studied.
- **Abstract**: summary of paper: The main reason for the study, the primary results, the main conclusions
- **Introduction**: *why* the study was undertaken
- **Methods and Materials**: *how* the study was undertaken
- **Results**: *what* was found?
- **Discussion**: *why* these results could be significant (what the reasons might be for the patterns found or not found)
- **Conclusion:**
- **Reference list:**

- **A/- Title**

The title should be very limited and specific. Really, it should be a pithy summary of the article's main focus.

B/- Abstract

This is a summary of your article. Generally, between 50-100 words, it should state the goals, results, and the main conclusions of your study. You should list the parameters of your study. Think of the process of writing the abstract as taking one or two sentences from each of your sections (an introductory sentence, a sentence stating the specific question addressed, a sentence listing your main techniques or procedures, two or three sentences describing your results, and one sentence describing your main conclusion) [26].

C/- Introduction

The introduction is where you sketch out the background of your study, including why you have investigated the question that you have and how it relates to earlier research that has been done in the field. It may help to think of an introduction as a telescoping focus, where you begin with the broader

context and gradually narrow to the specific problem addressed by the report. A typical (and very useful) construction of an introduction proceeds as follows:

1. Open with two or three sentences placing your study subject in context.
2. Follow with a description of the problem and its history, including previous research.
3. Describe how your work addresses a gap in existing knowledge or ability (here's where you'll state why you've undertaken this study).
4. State what information your article will address.

D/- Methods and Materials

In this section you describe how you performed your study. You need to provide enough information here for the reader to duplicate your experiment. However, be reasonable about who the reader is. Assume that he or she is someone familiar with the basic practices of your field [26].

It's helpful to both writer and reader to organize this section chronologically: that is, describe each procedure in the order it was performed. For example, DNA-extraction, purification, amplification, assay, detection. Or, study area, study population, sampling technique, variables studied, and analysis method.

Include in this section:

- study design: procedures should be listed and described, or the reader should be referred to papers that have already described the used procedure
- particular techniques used and why, if relevant
- modifications of any techniques; be sure to describe the modification
- specialized equipment, including brand-names
- temporal, spatial, and historical description of study area and studied population
- assumptions underlying the study
- statistical methods, including software programs

E/- Results

This section presents the facts--what was found in the course of this investigation. Detailed data--measurements, counts, percentages, patterns--usually appear in tables, figures, and graphs, and the text of the section draws attention to the key data and relationships among data. Three rules of thumb will help you with this section:

- present results clearly and logically
- avoid excess verbiage
- consider providing a one-sentence summary at the beginning of each paragraph if you think it will help your reader understand your data

Remember to use table and figures effectively. But don't expect these to stand alone.

Notice how the second sample points out what is important in the accompanying figure. It makes us aware of relationships that we may not have noticed quickly otherwise and that will be important to the discussion.

- **Related Information: Use Tables and Figures Effectively**

Do not repeat all of the information in the text that appears in a table, but do summarize it. For example, if you present a table of temperature measurements taken at various times, describe the general pattern of temperature change and refer to the table [26].

Remember that readers have all that data in the accompanying tables and figures, so your task in this section is to highlight key data, changes, or relationships.

F/- Discussion

In this section you discuss your results. What aspect you choose to focus on depends on your results and on the main questions addressed by them. For example, if you were testing a new technique, you will want to discuss how useful this technique is: how well did it work, what are the benefits and drawbacks, etc. [26]. If you are presenting data that appear to refute or support earlier research, you will want to analyze both your own data and the earlier data--what conditions are different? How much difference is due to a change in the study design, and how much to a new property in the study subject? You may discuss the implication of your research--particularly if it has a direct bearing on a practical issue, such as conservation or public health.

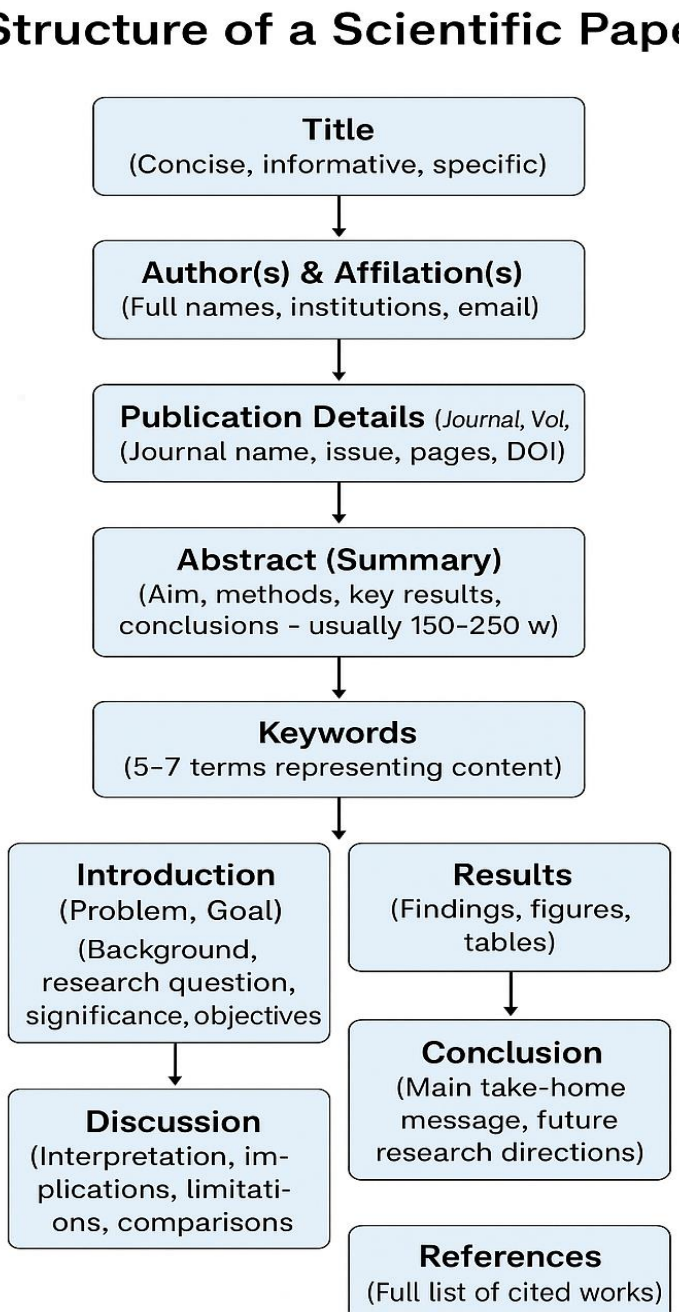

Figure.13: Structure of Writing a Scientific Paper

IV-7 Activities and exercises

***Exercise 1*:** Summarize this test using the necessary steps

Text: Plagiarism

Due largely to the amount of information available on the internet, it is becoming easier for everyone to plagiarize. Whether intentional or not, schools and universities consider plagiarism a form of academic dishonesty and unethical practice.

Obvious plagiarism includes buying a paper or copying another person's work and presenting it as yours. This can be information or items copied from Web pages, books and newspapers, TV shows or any other artwork. Essentially, it is a form of piracy; a theft of the author's intellectual property. The educational systems are so tolerant that the rate of plagiarism scandals has doubled in recent years.

One of the scholars pointed out, "before trying to avoid plagiarism, we must tackle the causes which include: the lack of academic integrity, the students' ignorance, their difficulty with citing, in addition to the weaknesses in language skills". The University of California, at Devis explains that the effects of plagiarism are ranging from damaging the student's academic career and causing serious legal problems to tarnishing the institution's reputation.

The policies detailing the guidelines on the problem of plagiarism that have been established should be explained by teachers periodically. Whenever ideas or works are borrowed from another source, students must cite or quote that source. This is the best way to minimize plagiarism.

***Exercise 2*:**

- What is the difference between a scientific text and a scientific paper?

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This Handout "**Technical English**" is intended for students in 2nd year of Electrical Engineering and Renewable Energy.

The Technical English course aims to:

- Know vocabulary and specialized terms specific to electrical engineering and renewable energies.
- Define the use of technologies such as calculators, spreadsheets, mathematical software, and data visualization tools.
- Explain technical concepts in one's own words.
- Apply grammatical rules correctly in technical writing.
- Examine the technical instructions by following them accurately.
- Construct key concepts from technical text or conferences
- Evaluate the effectiveness of different strategies and the features and structure of a scientific text.

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