



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT302 – TRANSMISSION LINES AND ANTENNAS

III YEAR/ V SEMESTER

UNIT 1 – TRANSMISSION LINE THEORY

TOPIC 4 – LOADING OF TRANSMISSION LINE



WHETHER A PRACTICAL TRANSMISSION LINE WILL SATISFY DISTORTION LESS CONDITION?

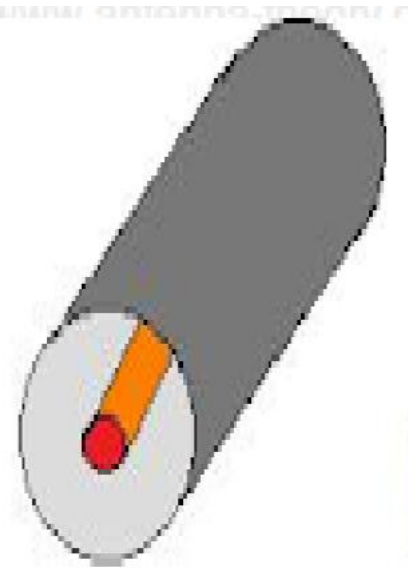


FIG. Underground Telephone Cables

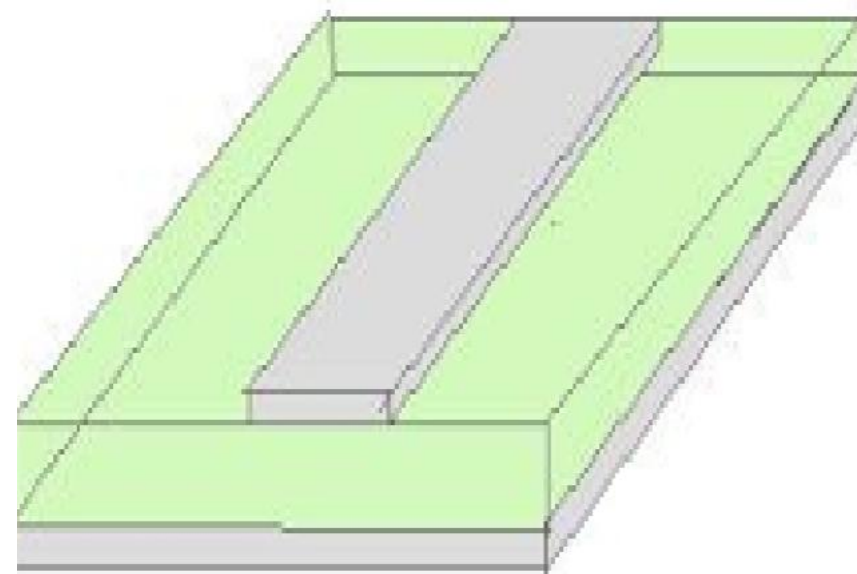


LOADING

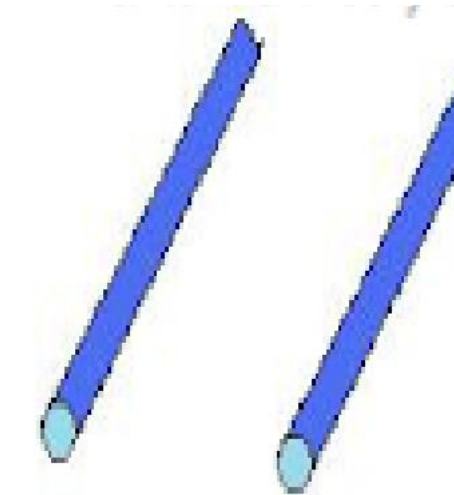
- Loading of transmission lines is used to achieve distortion less condition in practical transmission lines
- Anyway it is impossible to make practical transmission line as distortion less but we can minimize distortion



Coaxial Cable



Microstrip Line



Two-Wire Line



CONDITION FOR A DISTORTIONLESS LINE



- Condition for a distortion less transmission line is

$$\frac{R}{L} = \frac{G}{C}$$

- Reduce R – reduce R/L to the same values as G/C but this requires large conductors
- Reduce C – requires an increase in the spacing between the conductors but cable size and cost increased
- Increase G – increase leakage loss & it is undesirable
- So the inductance L is increased



LOADING AND LOADED LINES

- To achieve the above condition, the series inductance L could be increased by inserting artificial inductance in series with the line. This process is known as loading and such lines are called loaded lines

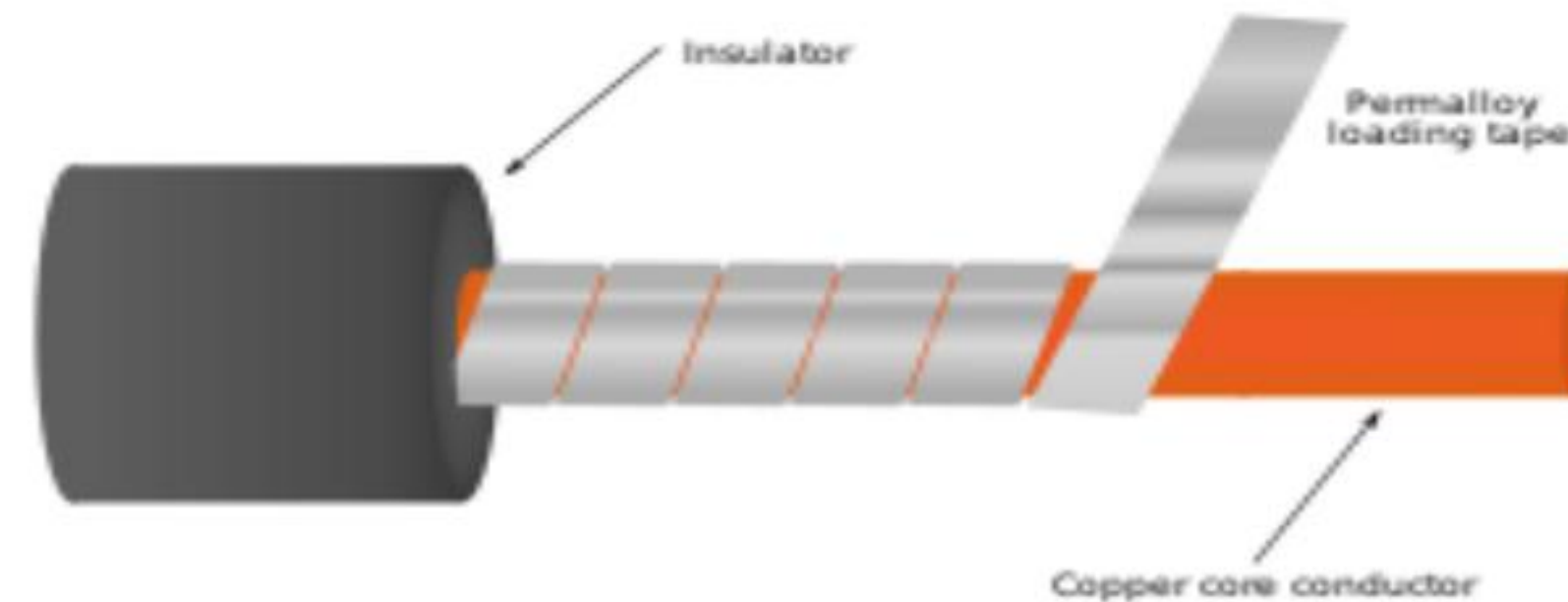


FIG. LOADING COIL



TYPES OF LOADING

- Loading is mainly done on telephone cables carrying voice signals
- Types of loading are
 - (i) Continuous loading
 - (ii) Lumped loading
 - (iii) Patch loading



FIG. LOADING COIL – SUBMARINE CABLE



CONTINUOUS LOADING

- The inductance of the line is increased uniformly along the length of the line
- A type of iron or some other high permeability magnetic material in the form of a wire or tape is wound around the copper conductors
- This will increase the permeability of the surrounding medium which in turn increases the inductance of the line





CONTINUOUS LOADING



➤ Advantages

- (i) Attenuation is constant over a wide frequency range
- (ii) Used only in submarine cables

➤ Disadvantages

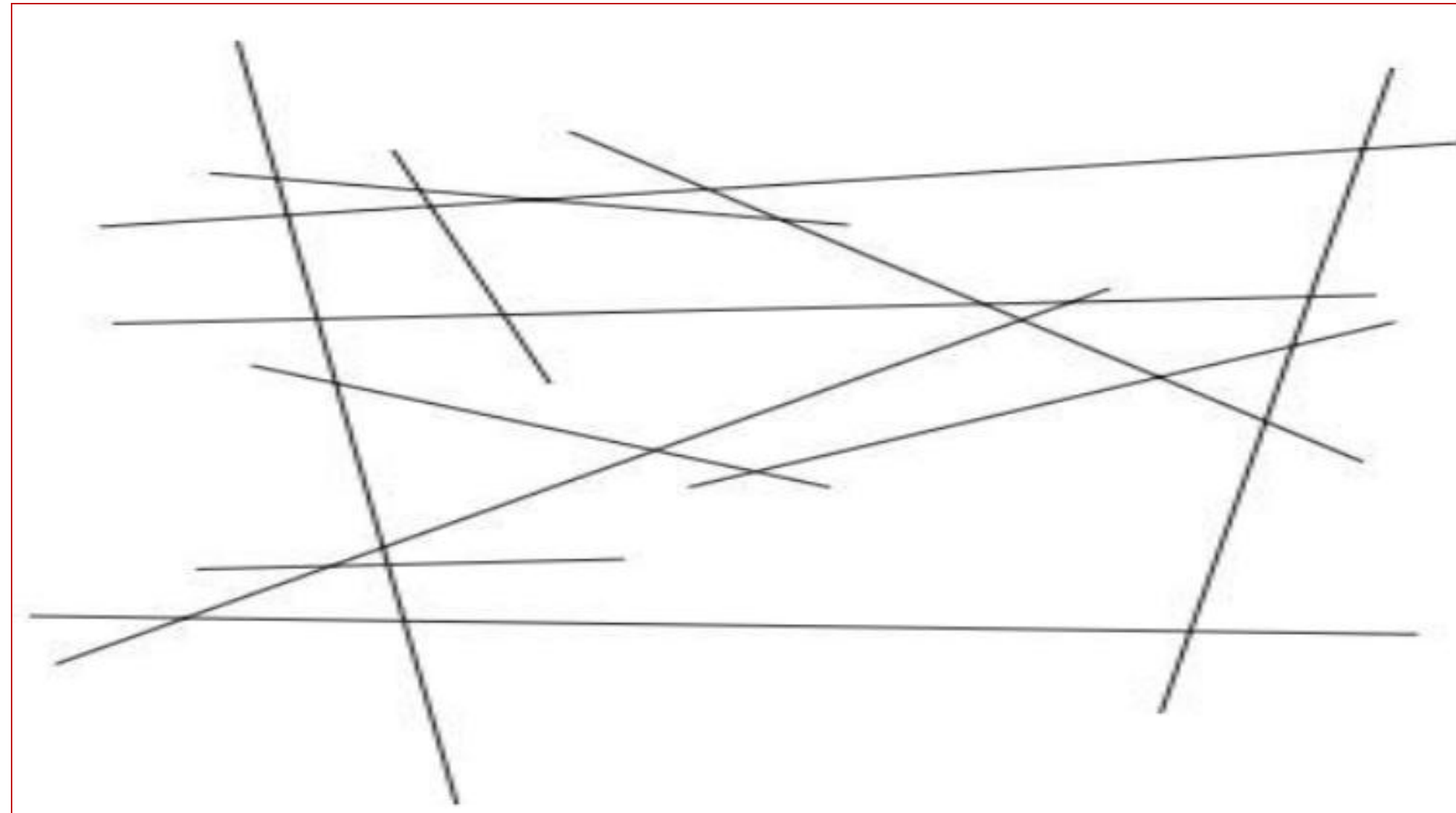
- (i) Very expensive
- (ii) Possibility of transmission delays
- (iii) Eddy current and hysteresis losses increase with frequency, thus increasing the value of R



ACTIVITY



How many lines appear in this picture ?





LUMPED LOADING

- The inductance coils are wound on a toroidal core and inserted periodically in series with the line
- This type of core produces coil of small dimension, high inductance and low eddy current losses





LUMPED LOADING



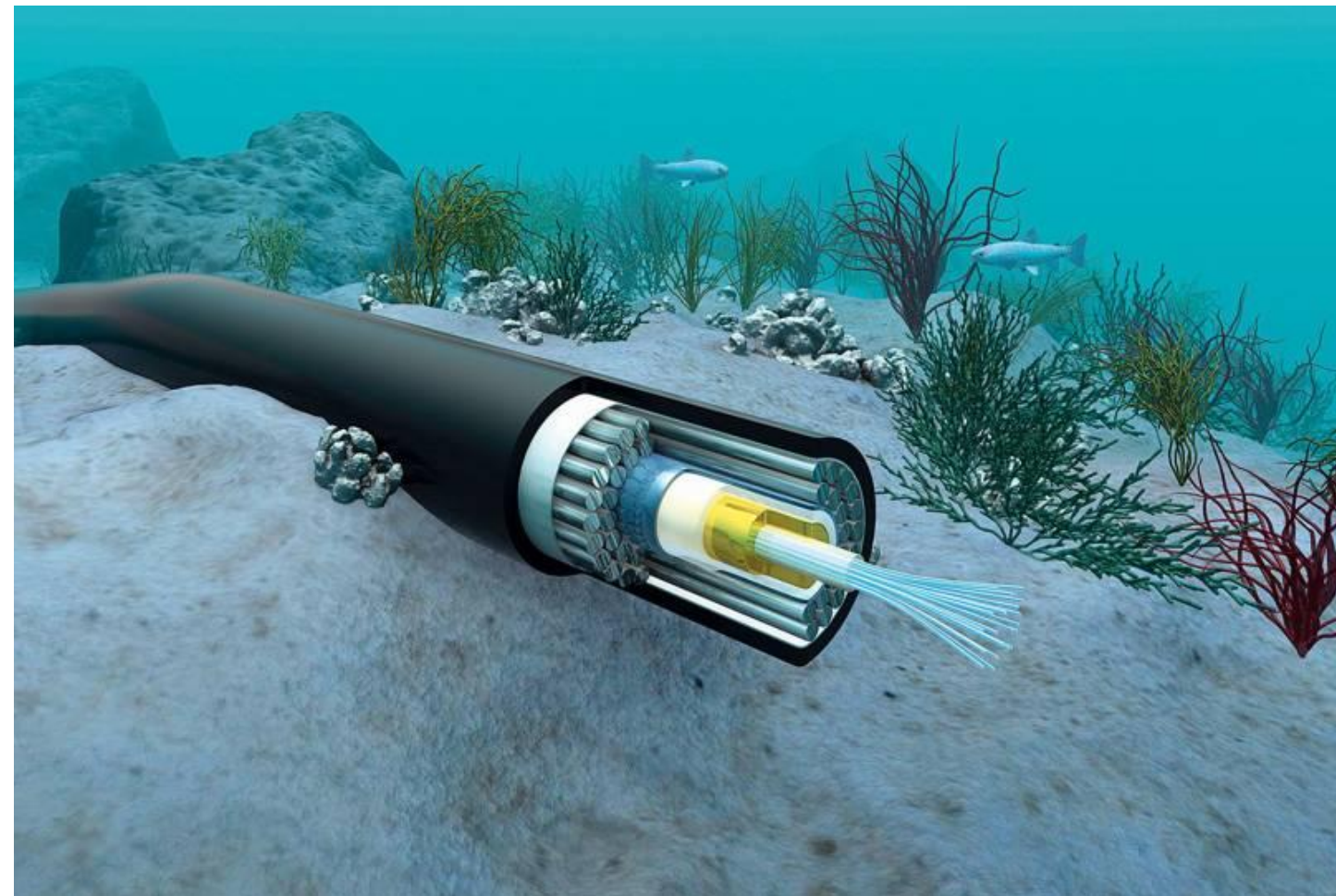
➤ Advantages

- (i) Large value of inductance is possible with reduced attenuation
- (ii) Method of loading is more convenient
- (iii) Eddy current and hysteresis losses are less



PATCH LOADING

- Employs sections of continuous loaded cable separated by sections of unloaded cable
- In submarine cables, patch loading is adequate to obtain the required reduction in attenuation





PATCH LOADING



➤ Advantages

- (i) Advantage of loading is obtained
- (ii) Cost is greatly reduced
- (iii) Reduction in attenuation



EFFECT OF LOADING ON SECONDARY CONSTANTS



- The characteristic impedance increases
- Attenuation constant is reduced
- Phase constant β is increased
- Phase velocity is reduced



ASSESSMENT



1. Define is loading and loaded lines?
2. Name the types of loading.
3. List the disadvantages of continuous loading.
4. What are the advantages of lumped loading?
5. What are the effects of loading on the secondary constants?



THANK YOU