UNIT-III

CORONA EFFECTS

Power loss and audible noise

- When compared to the *I*2*R* heating loss, the average corona losses on several lines from 345 kV to 750 kV gave 1 to 20 kW/km in fair weather, the higher values referring to higher voltages. In foul-weather, the losses can go up to 300 kW/km. Since, however, rain does not fall all through the year (an average is 3 months of precipitation in any given locality) and precipitation does not cover the entire line length, the corona loss in kW/km cannot be compared to *I*2*R* loss directly.

Corona loss formulae

- Corona-loss formulae were initiated by F.W. Peek Jr. in 1911. They all yield the power loss as a function of (*a*) the corona-inception voltage, *Vo*; (*b*) the actual voltage of conductor, *V*; (*c*) the excess voltage (*V* — *Vo*) above *Vo*; (*d*) conductor surface voltage gradient, *E*; (*e*) corona-inception gradient, *E*o; (*f*) frequency, *f*; (*g*) conductor size, *d*, and number of conductors in bundle, *N*, as well as line configuration; (*h*) atmospheric condition, chiefly rate of rainfall, ρ, and (*i*) conductor surface condition.

Charge voltage diagram

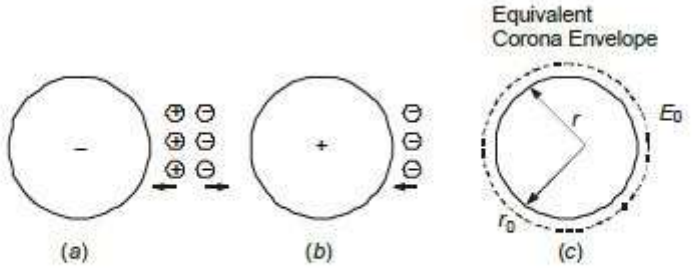

Fig. 3.2 Space-charge distribution in corona and increase in effective radius of conductor

Generation ,characteristics

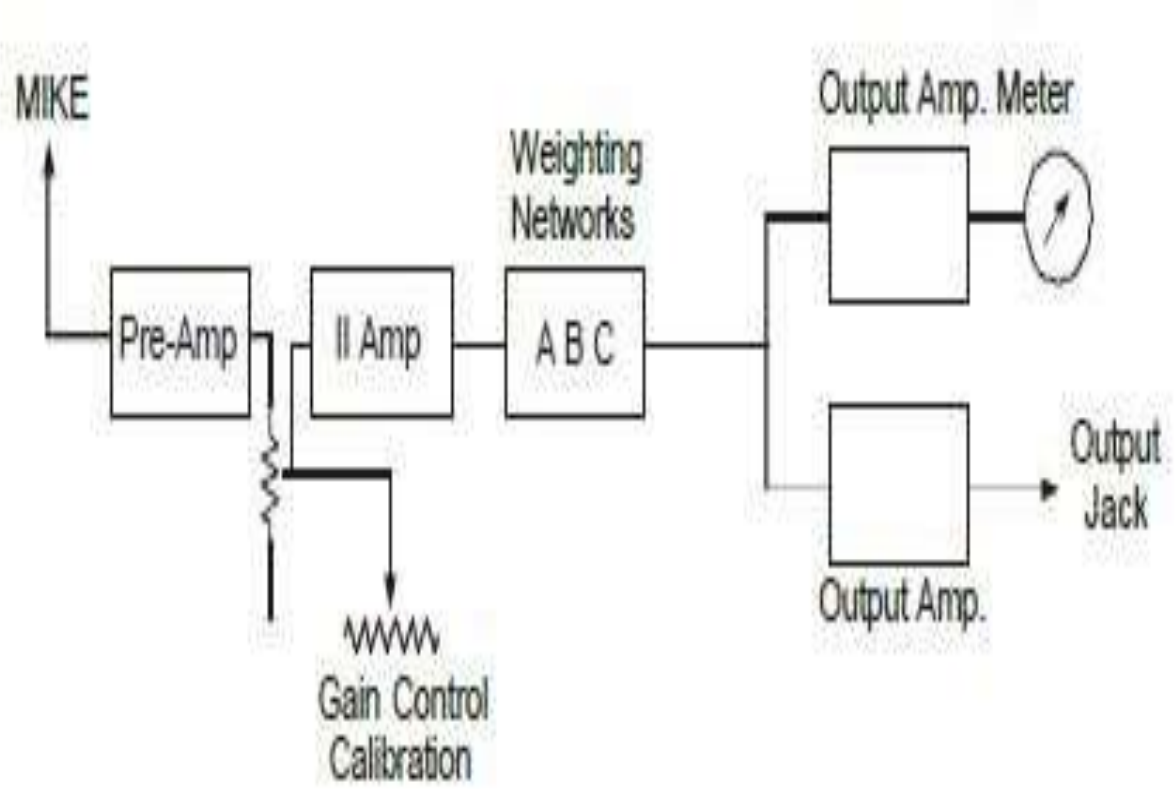

Fig. 3.6 Block diagram of AN Measuring Circuit.

Limits and measurements of AN

- The first such series of tests performed from a 500-kV line of the Bonneville Power Administration in the U.S.A. is known as Perry Criterion. The AN limits are as follows:
- No complaints : Less than 52.5 dB (*A*),
- Few complaints : 52.5 dB (A) to 59 dB (*A*),
- Many complaints : Greater than 59 dB (*A*),

Relation between 1-phase and 3-phase AN levels-Examples

- Obtaining data of AN and other quantities from e.h.v. lines involves great expense in setting up full-scale outdoor 3-phase experimental lines. Most of the design data can be obtained at less cost from a single-phase outdoor line or from cage experiments.

Radio interference

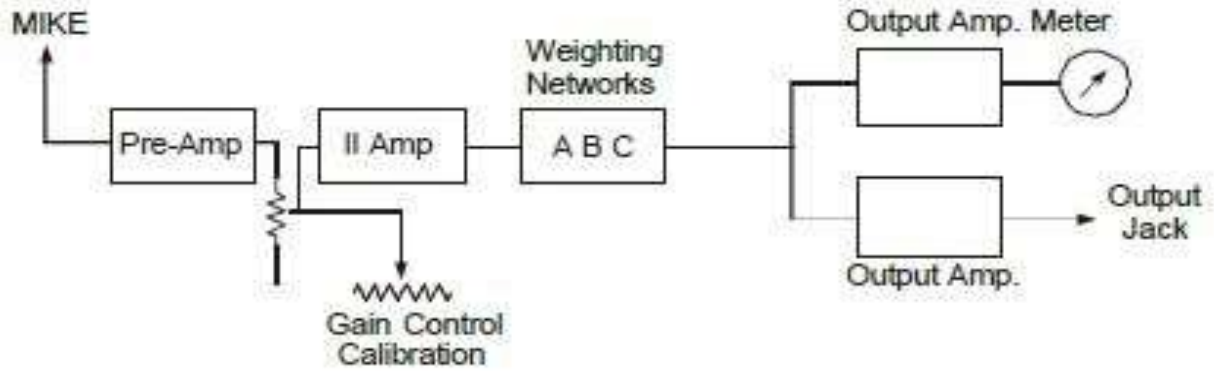

Fig. 3.6 Block diagram of AN Measuring Circuit.

Corona pulses generation

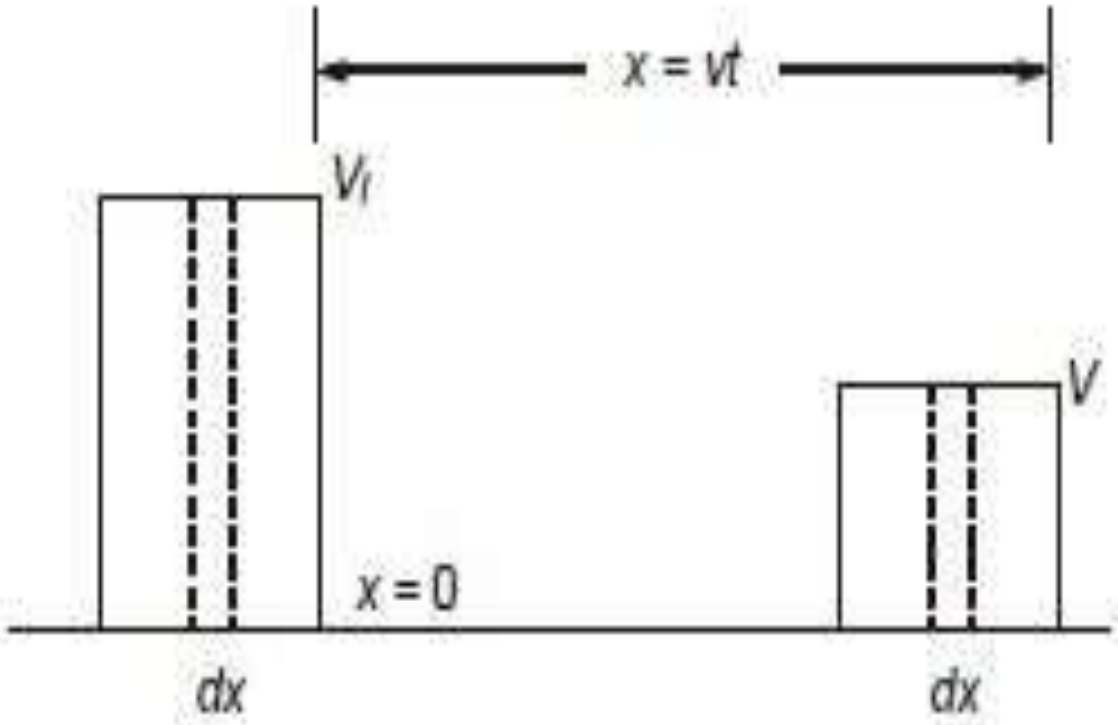

Fig. 3.4 Attenuation of voltage on a transmission line.

Properties, limits

- When corona is present on the conductors, e.h.v. lines generate audible noise which is especially high during foul weather. The noise is broadband, which extends from very low frequency to about 20 kHz. Corona discharges generate positive and negative ions which are alternately

Frequency spectrum , Modes of propagation , Excitation function

- The intereference to AM broadcast in the frequency range 0.5 MHz to 1.6 MHz is measured in terms of the three quantities : Radio Interference Field Intensity (RIFI or RI), the Radio Influence Voltage (RIV), and more recently through the Excitation Function. Their units are mV/m, mV, and mA/ m or the decibel values above their reference values of 1 unit (mV /m,mV,mA / m).

Measurement of RI, RIV and excitation functions-examples and problems

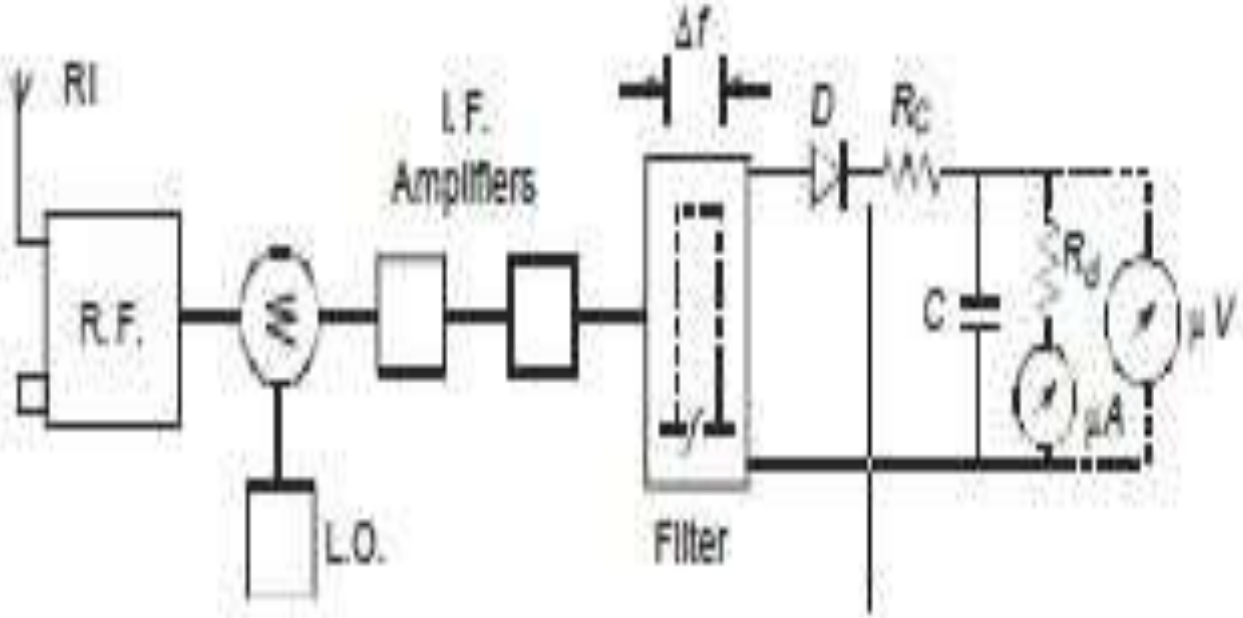

Fig. 3.10 Block diagram of Radio Noise Meter.

PROBLEMS

- Single smooth conductor 1 cm in radius is strung 5 metres above ground; using Peek's formula for corona-inception gradient, find
- (*a*) the corona-inception voltage,
- (*b*) the equivalent radius of conductor to the outside of the corona envelope at 20%
- overvoltage. Take d =1.