

كلية المأمون الجامعة

قسم هندسة تقنيات القدرة الكهربائية

المرحلة الرابعة

protective relay

أنظمة النقل والتوزيع

محاضرة رقم (15)

*A **protective relay** is a device that detects the fault and initiates the operation of the circuit breaker to isolate the defective element from the rest of the system.*

The relays detect the abnormal conditions in the electrical circuits by constantly measuring the electrical quantities which are different under normal and fault conditions.

(i) First part is the primary winding of a current transformer (C.T.) which is connected in series with the line to be protected.

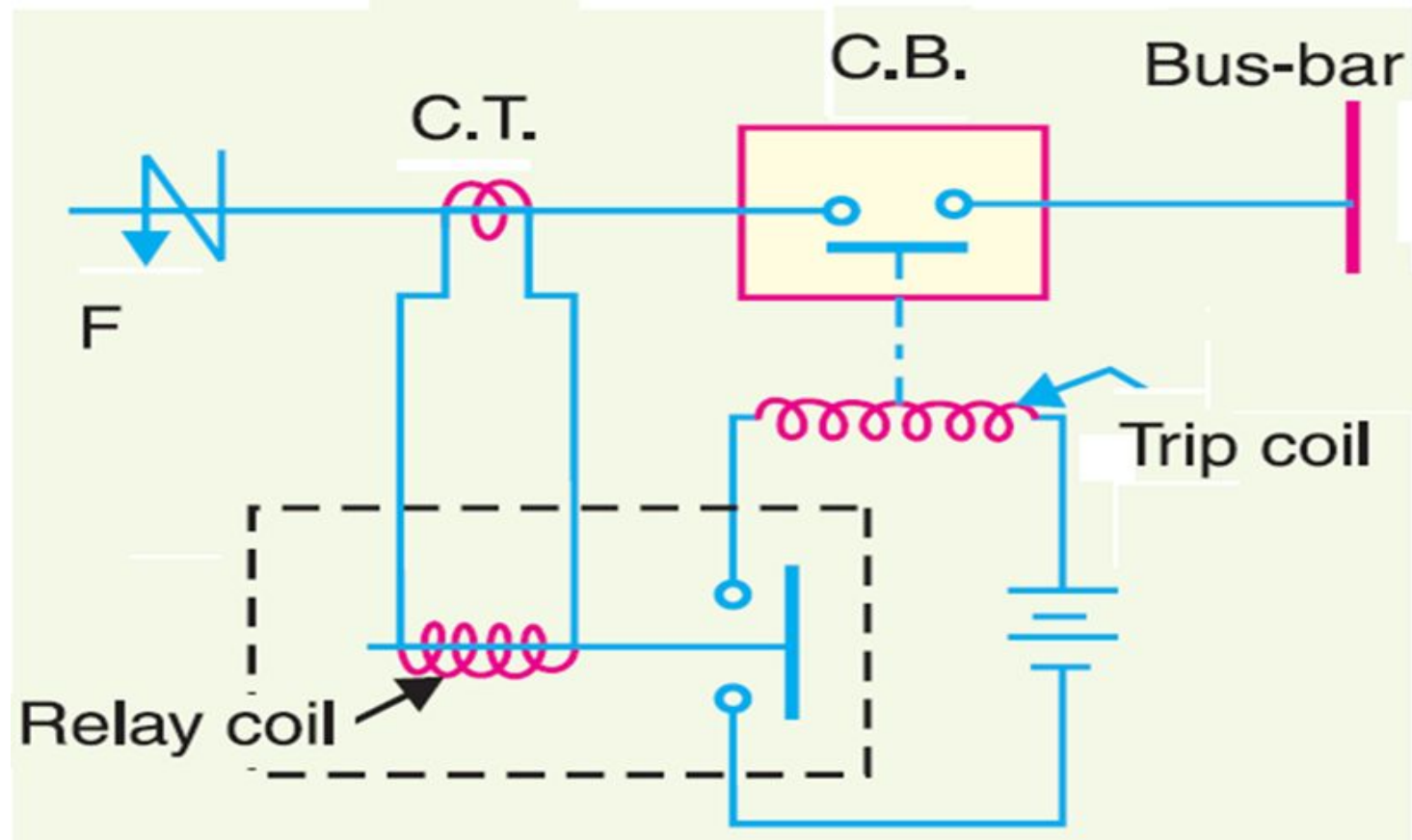
(ii) Second part consists of secondary winding of C.T. and the relay operating coil.

(iii) Third part is the tripping circuit which may be either a.c. or d.c. It consists of a source of supply, the trip coil of the circuit breaker and the relay stationary contacts.

Problems on the power system include:

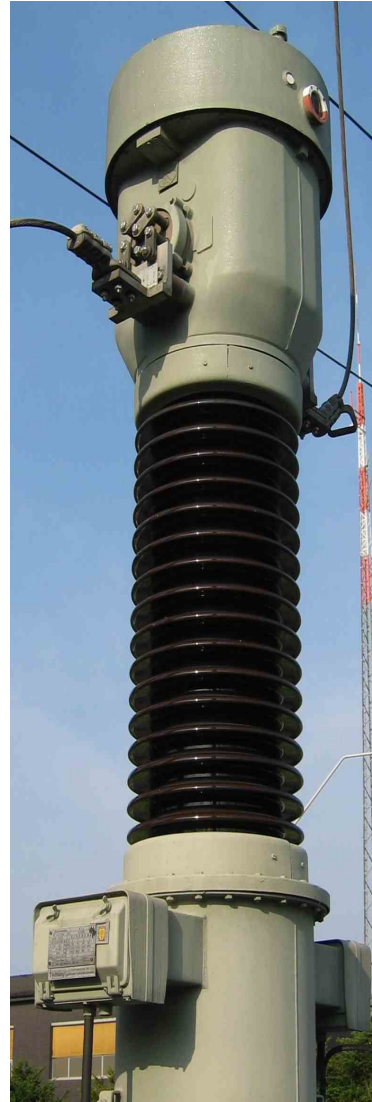
1. Short circuits
2. Abnormal conditions
3. Equipment failures

relay circuit





PT



CT

Fundamental Requirements of Protective Relaying

The principal function of protective relaying is to cause the prompt removal from service of any element of the power system when it starts to operate in an abnormal manner or interfere with the effective operation of the rest of the system. In order that protective relay system may perform this function satisfactorily, it should have the following qualities :

- (i) selectivity
- (ii) speed
- (iii) sensitivity
- (iv) reliability
- (v) simplicity
- (vi) economy

(i) Selectivity. *It is the ability of the protective system to select correctly that part of the system in trouble and disconnect the faulty part without disturbing the rest of the system.*

(ii) Speed. The relay system should disconnect the faulty section as fast as possible

(iii) Sensitivity. *It is the ability of the relay system to operate with low value of actuating quantity.*

(iv) Reliability. It is the ability of the relay system to operate under the pre-determined conditions.

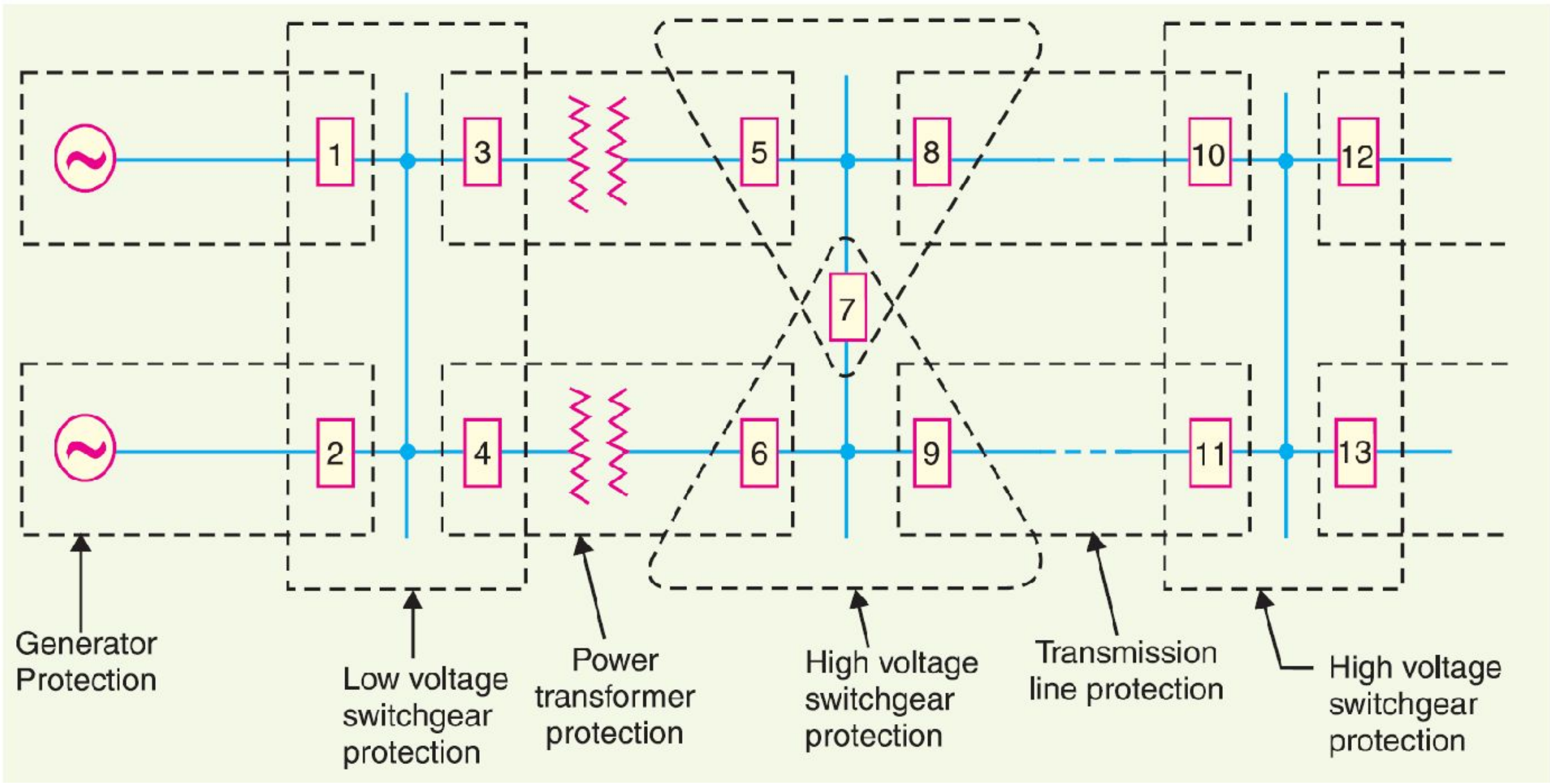
(v) Simplicity. The relaying system should be simple so that it can be easily maintained.

(vi) Economy. The most important factor in the choice of a particular protection scheme is the economic aspect.

Protection zone is defined as the part of the power system which is protected by a certain protective scheme.

When a fault occurs in a given zone, then only the circuit breakers within that zone will be opened. This will isolate only the faulty circuit or apparatus, leaving the healthy circuits intact. The system can be divided into the following protection zones :

- (a)** generators **(b)** low-tension switchgear **(c)** transformers
- (d)** high-tension switchgear **(e)** transmission lines **(f)** Capacitors



Generator Protection

Low voltage switchgear protection

Power transformer protection

High voltage switchgear protection

Transmission line protection

High voltage switchgear protection