

Total No. of printed pages = 4

CAI-603/SS&P/6th Sem/2013/M

**SUBSTATION, SWITCHGEAR  
AND PROTECTION**

Full Marks – 70

Pass Marks – 28

Time – Three hours

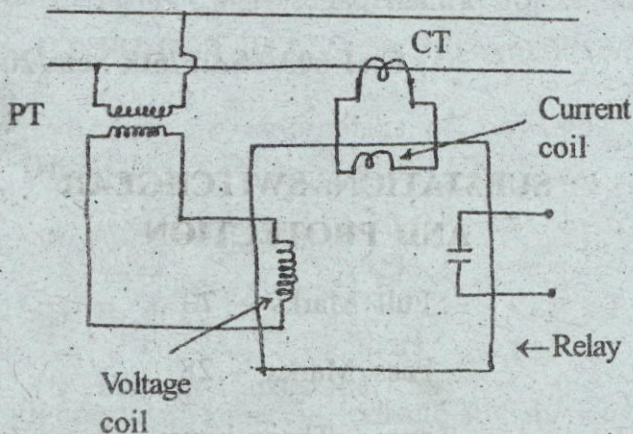
The figures in the margin indicate full marks  
for the questions.

Answer any *five* questions.

1. (a) What is relay ? Write about pick up level and reset level. 6
- (b) Derive the expression of torque produced in an induction relay. 6
- (c) Write universal torque equation of relay. 2
2. (a) Write about differential relay. What is percentage differential relay ? 3+2=5

[Turn over

(b)



Above figure shows connections of a directional relay. The voltage coil has an impedance of  $(210 + j 450)\Omega$ . At what power factor the relay develop maximum torque ?

It is desired to modify the relay such that it develops the same maximum torque at a lagging power factor angle of  $45^\circ$ , the load being fed in the same direction. What modification would you recommend ? 7

(c) Draw the operating characteristic of an impedance relay. 2

3. (a) What is substation ? Where is it located ?  
2+2=4

(b) Write the classification of substations. 4

- (c) What are the equipments of a substation ?  
Write briefly. 4
- (d) Why is underground substation required ? 2
4. (a) Write different types of neutral grounding.  
Why is Neutral grounding used ? 8+2=10
- (b) What are the disadvantages of ungrounded  
neutral system ? 4
5. (a) Write about symmetrical components. 4
- (b) In a 3-phase, 4-wire system, the currents in  
R, Y and B lines under abnormal conditions  
of loading are as under :
- $$\bar{I}_R = 100 \angle 30^\circ \text{A}, \quad \bar{I}_Y = 50 \angle 300^\circ \text{A}$$
- $$\bar{I}_B = 30 \angle 180^\circ \text{A}$$
- Calculate the positive, negative and zero  
sequence currents in the R-line and return  
current in the neutral wire. 10
6. (a) What is circuit breaker ? Write different  
methods of arc extinction. 2+5=7
- (b) What are the advantages and disadvantages  
of SF<sub>6</sub> circuit breaker ? 4

(c) Write operating principle of a circuit breaker. 3

7. (a) What are the equipments of a switchgear. 5

(b) Write the following : 3×3=9

(i) Bushing

(ii) Current transformer

(iii) Potential transformer.