Total No. of printed pages = 4

CAI-3204/SS&P/6th Sem/2013/M

SUBSTATION, SWITCHGEAR AND PROTECTION

Full Marks – 100

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. 8

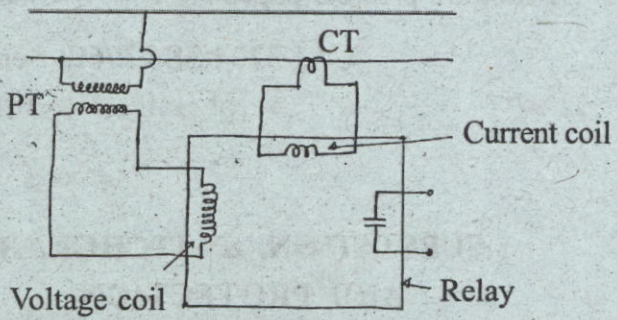
   (b) Derive the expression of torque produced in an induction relay. 10

   (c) Write universal torque equation of relay. 2

2. (a) Write about differential relay. What is percentage differential relay ? 4+4=8

[Turn over

(b)



Above figure shows connections of a directional relay. The voltage coil has an impedance of $(210 + j450)\Omega$. 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^{o}, the load being fed in the same direction. What modification would you recommend ? 10

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

3. (a) What is substation ? Where is it located ? 3+2=5

(b) Write the classification of substations. 7

(c) What are the equipments of a substation ? Write briefly. 6

(d) Why is underground substation required ? 2

4. (a) Write different types of neutral grounding. Why is neutral grounding used ? 10+4=14

(b) What are the disadvantages of ungrounded neutral system ? 6

5. (a) Write about symmetrical component. 8

(b) In a 3-phase, 4-wire system, the currents in R, Y and B lines under abnormal conditions of loading are as under :

$\bar{I}_R = 100 \angle 30^\circ A$; $\bar{I}_y = 50 \angle 300^\circ A$;

$\bar{I}_B = 30 \angle 180^\circ A$.

Calculate the positive, negative and zero sequence currents in the R-line and return current in the neutral line. 12

6. (a) What is circuit breaker ? Write different methods of arc extinction. 4+6=10

(b) What are the advantages and disadvantages of SF_6 circuit breaker ? 5

(c) Write the operating principle of a circuit breaker. 5

7. (a) What are the equipments of a switchgear ? 8

(b) Write the following : 3×4=12

(i) Bushing

(ii) Current transformer

(iii) Potential transformer.