Total No. of printed pages = 4

CAI-603/SS&P/6th Sem/2017/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 do you mean by the term short-circuit on an electric network ? Is there any difference between short-circuit current and overload current ? Between short-circuit and overload current, normally which current has the higher magnitude ? Explain in your own language with necessary diagram. 2+1+1+6=10

   (b) Write some important reasons for which an electrical engineer needs to calculate the short-circuit current ? 4

2. (a) What are the main equipment used in a transformer substation ? Explain briefly about them. 9

(b) Draw a neat diagram of typical electric supply system indicating the positions of step-up substation, primary grid substation, secondary substation etc. 3+2=5

Draw the symbols for the following equipment :

(i) 3-ϕ power transformer

(ii) Overcurrent relay

(iii) Earth fault relay

(iv) Lightning arrestor (active gap)

3. (a) "An earth fault usually involves a partial breakdown of winding insulation to earth. One method of protection against earth faults in a transformer is the core-balance leakage protection."

What is an earth fault and how a 3-φ transformer is protected using core balance leakage protection ? 7

(b) "Alternators are the heart of a power system. They are driven by Prime Movers in generating stations".

Describe briefly what will happen to an turbo and hydro generator set when the prime mover fails. Also discuss about the stator winding fault on an alternator. 7

4. (a) How the faults in a 3-φ system are classified? Explain briefly. 4

(b) The sequence voltages in the red phase are as under : 10

$\vec{E}_{R_0} = 100V$, $\vec{E}_{R_1} = (200 - j100)V$,

$\vec{E}_{R_2} = -100V$.

Find the phase voltages $\vec{E}_R$, $\vec{E}_y$ and $\vec{E}_B$.

5. (a) Discuss about the principles of arc extinction in circuit breakers. 2+2=4

(b) Describe the principle of operation and working of vacuum circuit breakers (VCB). Also mention two important advantages of VCB. 4+4+2=10

6. (a) "Selectivity, speed and sensitivity are the most important fundamental requirements of protective relaying."

Discuss in your own words about these three qualities for satisfactory performance of protective relay. 9

(b) Write briefly about the following : $2\frac{1}{2}+2\frac{1}{2}=5$

(i) Instantaneous relay

(ii) Inverse time relay.

7. Write short notes on any *two* : $7\times2=14$

(a) Arc suppression coil grounding

(b) Application of CT and PT in substation.

(c) Induction type overcurrent relay (non-directional).