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EX–603

B. E. (Sixth Semester) EXAMINATION, June, 2012

(Electrical & Electronics Engg. Branch)

SWITCHGEAR AND PROTECTION

(EX – 603)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt all questions. All questions carry equal marks.

1. (a) Describe the positive, negative and zero sequence networks in power systems. What is their significance ? 10

(b) A 11 kV, 15 MVA generator having $X_1 = 20\%$, $X_2 = 20\%$, $X_0 = 10\%$, is connected to a transformer rated 11/33 kV, 15 MVA having $X_1 = 5\%$. The transformer is delta connected on LT side and star connected on HT side. Neutral of generator and transformer is solidly earthed. Calculate fault current for double line to ground fault on HT and LT side. 10

Or

(a) A star connected synchronous motor is connected directly to a generator by means of bus bar of

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negligible reactance. Reactances of generator and motor are as follows :

$X_1 = 0{\cdot}2$ pu, $X_2 = 0{\cdot}2$ pu, $X_0 = 0{\cdot}1$ pu.

Both are rated at 11 kV, 1500 kVA. Generator is star connected with solid neutral; motor is delta connected. Calculate fault current for terminal L-L fault, L-G fault. 10

(b) What is the function of current limiting reactors ? Classify them on the basis of their types and location. 10

2. (a) Explain the following terms associated with Electro-mechanical relays :

Selectivity, Plug setting multiplier, Time multiplier setting, Protective zones, Primary and backup protection, Qualities of relaying. 10

(b) What is overcurrent protection ? How is it made selective ? Which type of relays are used and what are the different characteristics employed ? 10

Or

(a) What is distance protection ? Write the general torque equation of distance relays and derive different distance relay characteristics from it. Mention the fields of application of different distance relays. 10

(b) What are static relays ? Draw the block diagram and explain their principle of working. Compare their performance with electromechanical relays. 10

3. (a) Derive an expression for restriking voltage. Show that the RRRV is proportional to the natural frequency of the circuit. 10

(b) A three-phase alternator of rated line voltage of 13·5 KV is connected to a circuit breaker. The inductive reactance upto the circuit breaker is 4 ohm per phase. The distributed capacitance upto the circuit breaker between phase to neutral is $0{\cdot}2\mu$ F. Determine the following neglecting first pole to clear factor : 10

(i) Maximum RRRV.

(ii) Frequency of restriking voltage.

(iii) Peak restriking voltage across circuit breaker.

Or

(a) Discuss the recovery rate theory and energy balance theory of arc interruption in a circuit breaker. 10

(b) Discuss the construction, operating principle and application of SF_6 circuit breaker. What are its advantages ? For which voltage range is it used ? 10

4. (a) List the protection schemes employed for synchronous generator. Explain each in short explaining the consequences of mal operation of these protections in each case. 10

(b) Describe the percentage differential protection scheme for 3-phase alternator. Why does it not protect 100% of the winding against earth fault ? The winding protected depends on what factors ? 10

Or

(a) Draw and describe the protection scheme for a 11/6.6 kV star-delta transformer, and find the CT ratio on H.V side if the CT ratio on LV side is 500/5. 10

(b) Explain with sketches the set-up for carrier current relaying employed for transmission line protection. 10

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5. (a) What are the causes of overvoltage arising on a power system ? What are protective measures against over-voltage ? 10

(b) Explain switching surges and travelling wave which are caused as a result of them. 10

Or

(a) What is meant by insulation coordination? How are the basic insulation level (BIL) determined ? How is the apparatus tested against surge condition ? 10

(b) Discuss the advantages and limitations of different types of neutral earthing. Find the inductance and capacitance of the arc suppression coil for a 132 kV, 3-phase, 50 hertz, 192 km line having 3 conductors of diameter 20 mm arranged in a vertical plane with 4 metre spacing. 10