

1. A synchronous generator with a synchronous reactance of 1.3 p.u. is connected to an infinite bus whose voltage is one p.u. through an equivalent reactance of 0.2 p.u. The maximum permissible output is 1.2 p.u.

(a) Compute the excitation voltage  $E$ .

(b) The power output is gradually reduced to 0.7 p.u. with fixed field excitation. Find the new current and power angle  $\delta$ . (20%)

2. In a short-circuit test on a circuit breaker, the following readings were obtained on a single frequency transient;

(i) Time to reach the restriking voltage,  $50 \mu\text{sec}$ ;

(ii) The peak restriking voltage, 100 KV.

Determine the average RRRV and the frequency of oscillation.

(20%)

3. The rotor resistance and reactance of a squirrel-cage induction motor rotor at standstill are 0.1 ohm per phase and 0.8 ohm per phase respectively. Assuming a transformation ratio of unity, from the eight-pole stator having a phase voltage of 120 V at 60 Hz to the rotor secondary, calculate the following:

(a) Rotor starting current per phase

(b) The value of slip producing maximum torque.

(20%)

4. The zero and positive sequence components of an unbalanced set of voltages are

$$V_+ = 2$$

$$V_0 = 0.5 - j0.866$$

The phase A voltage is

$$V_A = 3$$

Calculate the negative sequence component and the B and C phase voltages.

(20%)

5. Explain each of the following terms:

- (i) Line traps
- (ii) Protective angle
- (iii) String efficiency
- (iv) Capacity factor
- (v) Contract demand
- (vi) Auxiliary power
- (vii) Insulation coordination
- (viii) Utilization factor
- (ix) Resonant grounding
- (x) Back-up protection

(20%)