

CS/B.Tech/Even/EE/6th Sem/EE-602/2014

2014

Power System-II

Time Alloted : 3 Hours

Full Marks : 70

**The figure in the margin indicate full marks.
Candidates are required to give their answers in their
own words as far as practicable**

**GROUP - A
(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any ten of the following:

10x1=10

- i) In load flow study Z_{bus} matrix is a**
- a) null matrix**
 - b) sparse matrix**
 - c) full matrix**
 - d) unity matrix**
- ii) A 50 Hz, four pole turbo alternator rated at 20 MVA, 132kV has an inertia constant $H=4$ kW sec/KvA. The K.E stored in the rotor at synchronous speed is:**
- a) 80 kJ**
 - b) 80 MJ**

- c) 40 MJ
 - d) 20 MJ.
- iii) Load flow study is carried out for
- a) Fault calculation
 - b) Stability
 - c) System planning
 - d) Load frequency control
- iv) An acceleration factor is used in load flow studies by:
- a) Gauss-Seidel Method
 - b) Newton Raphson Method
 - c) Decoupled Method
 - d) None of the above.
- v) A Power system is subjected to a fault which makes the zero sequence component of current equal to zero. The nature of fault is
- a) Double line to ground fault
 - b) Double line fault
 - c) Line to ground fault
 - d) Three phase to ground fault.
- vi) An equipment has per unit reactance of 0.9 pu to a base of 20 MVA, 33kv. The pu reactance to the base of 50 MVA and 11 kv will be
- a) 4.5
 - b) 20.25
 - c) 0.9
 - d) 2.
- vii) A three phase breaker is rated 2000 MVA, 33kv. Its making

current will be

- a) 35 kA
- b) 49 kA
- c) 70 kA
- d) 89 kA

viii) A bus bar is rated by

- a) Current and voltage only
- b) Current only
- c) Current, voltage and frequency
- d) Any of the above

ix) Equal area criterion is used to study

- a) Relative stability
- b) Transient stability
- c) Dynamic stability
- d) Steady state stability

x) Which of the following circuit breakers is not suitable for auto reclosing purpose?

- a) Airblast circuit breaker
- b) Oil circuit breaker
- c) SF₆ circuit breaker
- d) Vacuum circuit breaker

xi) Zero sequence currents are present in

- a) L-L fault
- b) L-G fault
- c) L-L-G fault
- d) both (b) & (c).

xii) The voltage of particular bus can be controlled by controlling

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- a) Phase angle.
- b) Reactive power of the bus.
- c) Active power of the bus.
- d) Phase angle and reactive power.

xiii) Equal area criterion is useful for the determination of

- a) Steady state stability.
- b) Transient stability of two machine power system.
- c) Transient stability of multi machine power system.
- d) Both steady state and transient stability of multi machine power system.

GROUP - B
(Short Answer Type Questions)

Answer any *three* of the following. 3x5=15

2. Three generators are rated as follows.

Generator 1: 100 MVA, 33 kV, reactance = 10%

Generator 2: 150 MVA, 32 kV, reactance = 8%

Generator 3: 110 MVA, 30 kV, reactance = 12%

Choosing 200 MVA and 35 kV as the base quantities, compute per unit reactances of the three generators referred to these base quantities. All the generators are connected to common bus-bars.

3. Draw the positive, negative and zero sequence networks for a three-phase unloaded synchronous generator with grounded neutral through impedance Z_n .

4. Two generating stations have short-circuit capacities of 1500 MVA and 1000 MVA respectively. Assume base MVA to be 100 MVA and the generating stations operating at 11 kV, are linked by an interconnecting cable having a reactance of 0.6 Ω /phase.

Determine the short circuit capacity of each station.

5. Explain equal area criterion as applied to power system stability.

6. Explain different methods of ARC extinction in a Circuit Breaker.

GROUP - C
(Long Answer Type Questions)

Answer any *three* of the following. 3x15=45

7. a) Explain why they are preferred over current relays in case of parallel feeders and Ring Main's protection.
- b) Determine the time of operation of a relay of rating 5A and having a relay setting of 125%, TMS = 0.6. It is connected to a supply circuit through a CT. 400/5 ratio. The fault current is 4000 A.

PSM are:	2	4	5	8	10	20
Operating time (Sec.) :	10	5	4	3	2.8	2.4

(6+9)

8. a) The line to ground voltages on a high voltage side of a step-up Transformer are 100kv, 33kv and 38kv on phase A, B and C respectively. The voltage on phase A leads that of phase B by 100° & lags that of phase C by 176.5° . Determine analytically the symmetrical components of the voltages on each phase.
- b) Explain with sketch, the construction, use, advantages and disadvantages of a SF6 circuit breaker used in a power system.

(8+7)

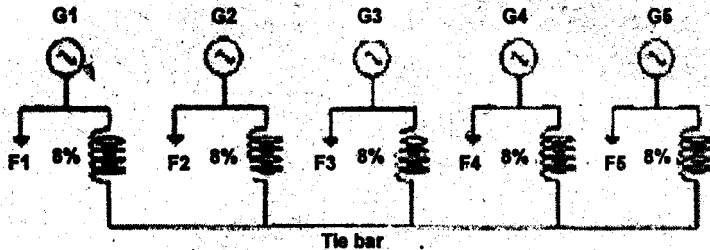
9. a) Draw a schematic diagram of thermal power plant showing all the major components.
- b) Explain the main four parts of a thermal power plant.

(7+8)

10. a) Two generators G1 & G2 rated 10 MVA, 11kV and 5MVA, 11 kV respectively are connected to a 15 MVA, 11 Δ /66Y kV step-up transformer with 10% reactance. If both the generators have a sub transient reactance of 20%, calculate the sub transient current in each generator when a 3-phase fault

occurs on high voltage side of the transformer assuming that there are no circulating currents in the machines.

- b) A generating station has five section bus bars connected with a tie bar through 8% reactor rated at 3000 kVA. Each generator is of 3000 kVA with 12% reactance and is connected to each section bus bars. Find the total steady input to a dead short circuit between the lines on one of the section bus bars (i) with reactor (ii) without reactor.



(8+7)

11. Draw the layout diagram of a Hydel power plant. Give detailed working principle of the Hydel power plant. [15]

12. a) Define the following terms:

- i) Steady state stability
- ii) Dynamic stability
- iii) Transient stability.

- b) If P_{max} is the maximum power that can be supplied by a cylindrical rotor synchronous machine, state whether the load can be suddenly raised to $0.9 P_{max}$ without destabilizing the machine when it is supplying $0.5 P_{max}$. Apply equal area criterion.

(6+9)

13. The following is the system data for a load flow solution: The line admittances:

Bus code	Admittance
1-2	$2-j8$
1-3	$1-j4$
2-3	$0.686-j2.664$
2-4	$1-j4$
3-4	$2-j8$

The scheduled of active and reactive powers:

Bus code	P	Q	V	Remarks
1	-	-	1.06	Slack
2	0.5	0.2	$1+j0.0$	PQ
3	0.4	0.3	$1+j0.0$	PQ
4	0.3	0.1	$1+j0.0$	PQ

Determine the voltages at the end of first iteration using Gauss Seidal method. Take $\alpha = 1.6$

(15)