Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/EE/SEM-8/EE-801B/2013

2013

POWER SYSTEM DYNAMIC & CONTROL

Time Allotted : 3 Hours *Full Marks* : 70

The figures 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 : $10 \times 1 = 10$

i) The maximum horsepower up to which 440 V electric motors are used is

a) 200 HP b) 50 HP

c) 20 HP d) 10 HP.

ii) Transient stability can be improved by using governors attached to the turbines of

a) low speed b) high speed

c) constant speed d) none of these.

iii) The insulation of EHV lines designed is based on

a) corona b) lightning voltage

c) switching voltage d) all of these.

iv) In a dynamically unstable system

a) oscillations may increase until synchronism is lost

b) governor action has no effect

c) load system is less than energy input

d) none of these.

v) Large capacity of generators are manufactured to generate power at

a) 400 V b) 6·3 kV to 10·5 kV

c) 132 kV to 220 kV d) 400 kV.

vi) Zero sequence components of voltage are absent in a

a) delta system

b) star system

c) star with neutral grounded system

d) all of these.

vii) 100% series compensation of lines is

a) low transient voltage

b) high transient current

c) the current in series resonant at power frequency

d) both (b) and (c).

viii) Shunt compensation in an EHV line is used to

a) improve stability

b) improve the voltage profile

c) reduce fault level

d) substitute for synchronous phase modifier.

ix) Skew is done in

a) shunt motor b) induction motor

c) alternator d) *d.c.* motor.

x) A synchronous condenser is a synchronous machine designed for

a) shunt reactive power compensation

b) series reactive power compensation

c) shunt capacitive power compensation

d) series reactive power compensation.

xi) The transmission losses in a line are

a) directly proportional to the voltage V

b) inversely proportional to the voltage V

c) directly proportional to V^2

d) inversely proportional to V^2.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Explain the following modelling of loads :

i) Constant current type

ii) Constant power type

iii) Constant impedance type.

3. Derive the equation of modelling of an induction motor.
4. What do you mean by components of power system ? What is small signal stability ?
5. "Synchronous condenser is one type of shunt compensator." Explain.
6. A 400 kV, 3-phase, 50 Hz power line has natural impedance of 300 ohms, while the electrical length is 0·5 radian. Obtain expression for (P/P_0) and V_m (in P.U.) in terms of power angle, when the line is in series capacitor compensated, the degree of compensation being 40%.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Deduce relation between voltage regulation, active power and reactive power in a two-bus transmission system connected through a line. Hence show how the receiving end voltage is sensitive to the change in flow of reactive power at the receiving end load bus, assuming the line to be lossless. 3 + 3

   b) Find out the expression for reactive power requirement for a long uncompensated transmission line. 4

   c) The load at the receiving end of a three-phase overhead line is 25 MW, power factor 0·8 lagging at a line voltage of 33 kV. A synchronous compensator is situated at a receiving end and voltage at both ends of the line is maintained at 33 kV. Calculate the MVAR of the compensator. The line has resistance of 5 ohms per phase and inductive reactance 20 ohms per phase. 5

8. a) Discuss the effects of passive series compensator and shunt compensator on surge impedance loading (SIL) of transmission line. What will be the effect on SIL if both the series and shunt compensators are used simultaneously ? 5 + 2

b) What is an S.V.C. ? Explain its principle of operation. How would you model an S.V.C. in power system ?

2 + 3 + 3

9. a) What is the significance of reactive power in power system ? Prove that voltage regulation in a transmission line mainly depends on reactive power. 3 + 5

b) An inductive load draws power of (2 + j 1) MVA at a receiving end bus of a radial three-phase line. The receiving end bus voltage is 11 kV at 50 Hz and the system reactance is 0·5 Ω/phase. Calculate (i) the receiving end current, (ii) voltage regulation, (iii) the sending end voltage and (iv) the short capacity of the system. Assume the system to be lossless. 7

10. a) Discuss the effect of exciter on small signal stability. 5

b) What is power system stabilizer ? Explain its role in enhancing small signal stability of power system. Also mention the different forms of realization of power system stabilizer. 10

11. Write short notes on any *three* of the following : 3×5

a) Subsynchronous resonance

b) Voltage collapse

c) Facts controller

d) Voltage security

e) PSS.

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