Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS / B.TECH (EE-NEW)/ SEM-8 / EE-801B / 2011

2011

POWER SYSTEM DYNAMICS AND 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 torque angle of a synchronous machine operating from a constant voltage bus, is usually defined as the space angle between

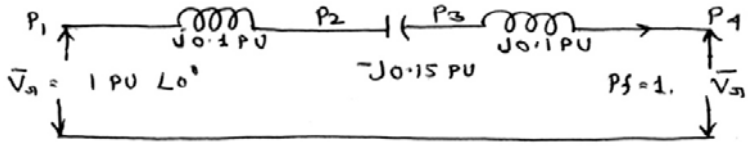
a) rotor *mmf* wave & stator *mmf* wave

b) rotor *mmf* and resultant flux density wave

c) stator *mmf* wave & resultant flux density wave

d) stator *mmf* wave & resultant *mmf* wave.

ii) Consider the model shown in figure below of a transmission line with a series capacitor at its mid point. The maximum voltage on the line is at the location



a) P_1 b) P_2

c) P_3 d) P_4.

iii) If a short transmission lane is delivering to a lagging *pf* load, the sending end *pf* would be (notations have their usual meaning)

a) $\frac{V_R \cos\phi + IR\sin\phi}{V_S}$ b) $\frac{V_R \cos\phi + IR}{V_S}$

c) $\frac{V_R \sin\phi + IR}{V_S}$ d) $\frac{VR\sin\phi + IR\cos\phi}{V_S}$.

iv) The voltage phasor of a circuit is $10\angle 15°V$ and the current phasor is $2\angle 45°A$. The active and the reactive power in the circuit are

a) 10W & 17·32 VAR b) 5W & 8·66 VAR

c) 20W & 60 VAR d) $20\sqrt{2}$ W & $10\sqrt{2}$ VAR.

v) In Var compensators using SCRs

a) filters are not necessary

b) the dominant harmonic is second

c) filters are needed for 5th & 7th harmonic

d) capacitors are switched on the h.v. size only.

vi) Rapid changes in system voltage cause

a) flicker b) voltage dips

c) corona d) loss of synchronism.

vii) The transmission losses in a line are

a) directly proportional to voltage V

b) inversely proportional to voltage V

c) directly proportional to V^2

d) inversely proportional to V^2.

viii) Voltage response of an exciter in expressed as

a) volts/sec

b) volts/ampere

c) field ampere per output amperes

d) change in field voltage to change in output voltage.

ix) A power system stabilizer improves

A. phase lag

B. improves damping

C. produces torque in phase with speed

a) (A) & (B) are correct

b) (B) & (C) are correct

c) (A) & (C) are correct

d) (A), (B) & (C) are correct.

x) The voltage regulator block diagram shows an

A. inherent phase lag

B. inherent phase lead

C. inherent steady state error

D. inherent instability at larger gains.

a) (A) & (B) are correct

b) (B) & (C) are correct

c) (B), (C) & (D) are correct

d) (A), (C) & (D) are correct.

xi) SSR phenomenon is

a) purely electrical b) purely mechanical

c) purely hydraulic d) both (a) and (b).

xii) The effect of increasing gating angle in a SCR controlled reactor is

a) to increase the effective inductance of the reactor

b) to reduce the effective reactive power

c) both (a) and (b)

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. What is load compensation ? Discuss its objectives in power system.

3. Explain the torque-frequency model of an induction motor.

4. What is flexible a.c. transmission system (FACTS) ? Mention various devices used in this system.

5. Discuss the effect of exciter on small signal stability.

6. Differentiate between steady state stability and transient stability of power system. Discuss the factors that affect transient stability of a system.

GROUP – C

(Long Answer Type Questions)

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

7. a) How is a power system simulated for small perturbation ?

   b) Clearly explain how a synchronous generator is modelled for steady state analysis. Draw the phasor diagram and obtain the power angle equation for a non-salient pole synchronous generator connected to an infinite bus.

5 + 10

8. a) Explain the reason for variations of voltage in power systems and explain one method to improve voltage profile.

   b) A short line having an impedance of (2 + J3) ohm interconnects two power stations *A* & *B* both operating at 11 KV, equal in magnitude & phase. To transfer 25 MW at 0·8 power factor logging from *A* to *B*, determine the voltage boost required at plant *A*. 7 + 8

9. a) What is a static compensation ?

   b) Explain with neat diagram the operation of

      i) Thyristor controlled reactor

      ii) Thyristor controlled capacitors

      iii) Saturated reactors. 3 + 12

10. a) Explain "Small signal stability of a single machine on infinite bus."

    b) Discuss the phenomenon of subsynchronous resonance in power system operations. Suggest remedies to overcome this problem. 6 + 9

11. a) Explain the terms (i) Voltage security , (ii) Voltage stability, (iii) Stability margin.

    b) A 3-phase overhead line has per phase resistance & reactance of 6 Ω and 20 Ω respectively. The sending end voltage is 66 KV while the receiving end voltage is maintained at 66 KV by a synchronous phase modifier. Determine the KVAs of the modifier when load at the receiving end is 75 MW at *pf* 0·8 lagging. 9 + 6

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