*Seat No.: _____* *Enrolment No._____*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. II$^{ND}$ Semester Examination – June/July- 2011**

**Subject code: 1720703**

**Subject Name: Power System Dynamics & Control**

**Date:27/06/2011** **Time: 10:30 am – 01:00 pm**

**Total Marks: 70**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | State conditions for synchronizing alternator with infinite bus considering fixed mechanical power i/p.<br>How alternator acts as condenser to control reactive power ? | **07** |
| | **(b)** | State basic assumptions made in steady state analysis of an alternator and derive open circuit voltage equation of it. | **07** |
| **Q.2** | **(a)** | Using Park transformation derive voltage equation of synchronous machine. Also state importance of Park transformation. | **07** |
| | **(b)** | State all assumptions made to develop dynamic model of synchronous machine and derive its all equations and draw phasor diagram. | **07** |
| | | **OR** | |
| | **(b)** | From basic of energy consumption principle derive mechanical equation for alternator. | **07** |
| **Q.3** | **(a)** | Given a round-rotor generator with Va = 1.0, Xs = 1.6, r = 0.004 and Ia = 1 ∠-60°. Find Ea, draw a phasor diagram. | **06** |
| | **(b)** | Derive equation for direct axis and quadrature axis voltages (Vd,Vq) for non-synchronous operation of an alternator considering balanced terminal voltages with Va (t) = √2 \|V\| cos (Wo t + ∠V). The rotation of generator is described by θ = Wo t + ( Π / 2 ) + § | **08** |
| | | **OR** | |
| **Q.3** | **(a)** | Draw and explain IEEE Type-1 excitation system. Also explain Excitation System Stabilizer (ESS) and Transient Gain Reduction (TGR) for excitation system modeling. | **07** |
| | **(b)** | Draw and explain speed-governing system and model of speed-governing system for hydro turbines. | **07** |
| **Q.4** | **(a)** | Explain types of SVC. Where it is used ? | **07** |
| | **(b)** | Classify the system load. Also state various mathematical model to represent system load. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Prove that, if the armature flux linkages components, with respect to a synchronously rotating reference frame are constants, then the transformer emf terms and terms introduced by the variations in rotor speed cancel each other. | **07** |
| | **(b)** | Develop dynamic model of synchronous machine with field circuit and two equivalent damper windings on q-axis (Model 2.2). Develop all equations of stator and rotor and draw its equivalent circuit. | **07** |

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|---|---|---|---|
| **Q.5** | **(a)** | Carry out small signal analysis of excitation system of synchronous machine connectes to infinite bus through transmission line. Also draw its block-diagram. | **08** |
| | **(b)** | Write short-note on Hopf Bifurcation. | **06** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | State assumption made in Multi machine system and develop simplified system model for the same. | **08** |
| | **(b)** | Explain line modeling by D-Q transformation using α-β variables. | **06** |

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