



VI SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: POWER SYSTEM OPERATION AND CONTROL [ELE 4008]

REVISED CREDIT SYSTEM

Time: 3 Hours

Date: 24th April 2018

Max. Marks: 50

Instructions to Candidates:

- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

- 1A.** A 500kV transmission line with total impedance of $(50+j100) \Omega$ is fed through 132/500 kV transformer from a constant 132 kV supply. The voltage is reduced by another transformer of ratio 500/132 kV at the load end of the line. Both transformers are equipped with tap changing facilities. If the load on the system is 200 MW at 0.8 p.f. lagging, find the settings of the tap changers required to maintain the voltages at the both ends at 132 kV. (03)
- 1B.** Calculate i_d and i_q corresponding to synchronous operation of generator, with $I_a = -j1$ and $\delta = 0$. (02)
- 1C.** From the fundamentals, derive the expression for voltage and current for midpoint series compensated transmission line. (05)
- 2A.** The fuel cost functions for three thermal plants in \$/h are given by
- $$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
- $$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
- $$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$
- Where P_1 , P_2 and P_3 are in MW. The total load is 800 MW. Neglecting line losses and generator limits, find the optimal dispatch of the plants. (04)
- 2B.** How are FACTS controllers classified? What are the benefits with the application of FACTS controllers? (04)
- 2C.** The regulation parameter R of 100 MW, 50 Hz generator is 3.5%. By how much will the turbine power increase if the frequency drops by 0.12 Hz with the speed changer setting unchanged. (02)

- 3A.** Derive the expression for voltage equation of an alternator using Park's variables and draw the equivalent circuit model. **(07)**
- 3B.** Explain the role of power system stabilizer to improve dynamic stability. **(03)**
- 4A.** Derive the block diagram representation of a single area system including power system response. **(05)**
- 4B.** A 3 phase 500kV, 300km, 60 Hz transmission line has the line inductance of 0.97 mH/km per phase and capacitance of 0.0115 μ F/km per phase. The line supplies a load of 800 MW of active power and 600MVAR of reactive power at 500 kV. Determine the MVAR rating and capacitance of the shunt compensating device to be installed at the receiving end to maintain 500 kV. **(05)**
- 5A.** Prove that the Park's transformation has the property of power invariance. **(03)**
- 5B.** Find the open loop gain K of the static AVR, for the static error to be less than 4% of reference input. Why feedback stability compensation is used to the AVR loop? **(02)**
- 5C.** Formulate the economic dispatch problem for ' N_g ' number of thermal power plants supplying a total load of ' P_L ' through a transmission network with a total line loss amounting to ' P_{LOSS} '. **(05)**