BITS, PILANI – DUBAI
Dubai International Academic City, Dubai

Semester II   2007 – 2008
IV Year (EEE)-Elective

Comprehensive Examination (Closed Book)

Course No.: EEE UC462   **Course Title:** Advanced Power Systems

Date: 25.05.2008   **Time: 03 Hours**   **M.M. = 40 (40 %)**

Please note:
1. *Attempt all questions, preferably in serial order.*
2. *All the symbols used, carry their usual meanings.*
3. *Assume suitable data, if needed.*

Q1   Two generators rated at 10MVA, 13.2kV and 15 MVA, 13.2 kV are connected in parallel to a bus bar. They feed supply to two motors of input 8 MVA and 12 MVA respectively. The operating voltage of the motors is 12.5 kV. Assuming base quantities as 50 MVA and 13.8 kV, draw the reactance diagram. The percentage reactance for the generators is 15 % and that of the motor is 20 %.   [5]

Q2   Calculate the capacitance to neutral in F/m of a single phase line composed of two single strand conductors each having a dia of 0.229 inch; the conductors are 10 ft apart and 25 ft above the ground.   [5]

Q3. The estimated short circuit MVA at the bus bars of a generating station A is 1500MVA and of another station B is 1200MVA. The generated voltage at each station is 33kV. If these stations are interconnected through a line having a reactance of 1 ohm and negligible resistance, calculate the possible SC MVA at both stations.   [5]

Q4   A turbo alternator with 4 pole, 50 Hz, 80 MW, 0.8 pf lagging, and a moment of inertia 40, 000 kgm^2 is interconnected via a short transmission line to another alternator with 2 pole, 50 Hz, 100 MW, pf 0.8 lag and moment of inertia 10, 000 kgm^2. Determine the inertia constant of the single equivalent machine on a base of 100 MVA.   [5]

Q5. (a) The tariff in force is AED 150 per kVA of maximum demand and 8 fills per unit consumed. If the load factor is 30%, find the overall cost per unit at unity pf and 0.7 pf.
     (b) Prove that in a string of insulators, the disc nearest to the conductor has maximum voltage across it. Justify your expression obtained.   [5+5]

Q6   (a) Explain the essential factors which influence the choice of site for a hydro-electric plant.
     (b) Discuss the arc phenomenon in a circuit breaker.
     (c) What is Corona? What are the factors which affect corona? What are its advantages and disadvantages?   [3+3+4]

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Date: 20.04.2008   Time: 50Minutes   M.M. = 20 (20 %)

- *Attempt all Questions, maintain the serial order.*
- *Assume missing data, if any.*
- *Only Text Book & handwritten class notes allowed. No Xerox material under any case is allowed.*

Q1.   Using rigorous method, derive expressions for sending end voltage and current for a long transmission line.

In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self capacitance of each insulator, find the distribution of voltage over three insulators and the string efficiency.   [2 + 3]

Q2.   An overhead line has a span of 150 m between level supports. The conductor has a cross sectional area of 2 cm^2. The ultimate strength is 5000 kg/cm^2 and safety factor is 5. The specific gravity of the material is 8.9 gm/cc. The wind pressure is 1.5 kg/m. Calculate the height of the conductor above the ground level at which it should be supported if a minimum clearance of 7 m is to be left between the ground and the conductor.   [5]

Q.3   A delta connected load is supplied from a 3-phase supply. The fuse in the B line is removed and current in the other two lines is 20 A. Find the symmetrical components of line currents.   [5]

Q.4.   Derive Swing equation.

Station A transmits 50 MW of power to station B through tie line. The maximum steady state capacity of the line is 100MW. Determine the allowable sudden load that can be switched on without loss of stability.   [5]

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Date: 09.03.2008   Time: 50Minutes   M.M. = 25 (25 %)

- *Attempt all Questions, maintain the serial order.*
- *Assume missing data, if any.*

Q1   Draw the neat schematic diagram for a thermal power plant and explain why fluidized bed combustion technology is used? Also explain cogeneration.   [4+1+2]

Q2.   A supply company offers the following alternate tariffs for supply to a factory:

      H V supply at AED 70/kVA/Annum plus 3 fills/kWh

      ii   L V supply at AED 65/kVA/Annum plus 4 fills/kWh

      The cost of transformer and switchgears for HV supply is AED 50/kVA and full transformation losses are 2%. The annual fixed charges on the capital cost of HV plant are 15%. If factory runs for 6 hrs a day, find the number of days above which the factory should be run so that the HV supply is cheaper   [6]

Q3.   An overhead 3 phase short transmission line delivers 5000kW at 22kV at 0.8 pf lagging. The Resistance and reactance of each conductor is 4 Ohm and 6 ohm respectively Determine sending end voltage and % regulation and transmission efficiency.   [6]

Q4   Find out the expression for per unit impedance in terms of Z, MVA and kV.

      Draw the impedance diagram for the following: [3+3]