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1 March 2017 (Evening)

Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch : **EEE** **Semester** : **4th**

Title of the Course : **Power Systems** **Course Code** : **EEL 253**

Time: 2 Hours **Maximum Marks: 25**

Note : 1. This paper contains 6 questions in 2 printed pages.

2. Answer all the questions.

3. Do not write anything on the question paper except Roll number

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1. A *d.c* 2 wire system is to be converted into *a.c* 3- phase 3 wire system by the addition of a third conductor of the same size as the two existing conductors. Calculate the percentage additional balanced load which can now be carried by the conductors at *p.f* of *0.95* lagging with the same voltage between the conductors and the same percentage power loss. **[4]**

2. Determine the most economical conductor size of a 3-phase line which supplies the following loads at *10 kV*.

   (i) *1,000 kW* at *0.8 p.f* (lag) for 10 hours,

   (ii) *500 kW* at *0.9 p.f* (lag) for 8 hours and

   (iii) *100 kW* at *unity p.f* for 6 hours

   The above gives the daily load cycle. The cost per km of the completely erected line is *Rs. (8000a + 1500)* where *a* is the area of cross section of each conductor in cm^2. the combined interest and depreciation is *10* percent per annum of capital cost. Cost of energy losses is *80 paise per kWh.* Resistivity of conductor material is $1.72\times10^{-6}\,\Omega-cm$. **[4]**

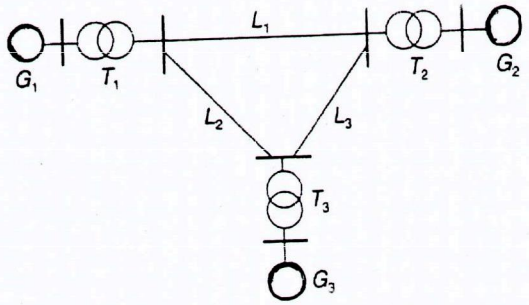
3. An electrical supply undertaking has a maximum demand of *80 MW* with an annual load factor of *50 %*. The capital cost of distribution is *Rs. 18,00,000* with a diversity factor of *1.4*. The capital cost of transmission is *Rs. 20,00,000* with a diversity factor of *1.25*. The efficiency of transmission system is *85 %* and that of distribution is *88 %*. The generating cost inclusive of capital cost is *Rs. 75* per *kW* of maximum demand plus 2 *paise* per *kWh*. Calculate the annual cost per *kW* of Maximum demand and the cost per *kWh* supplied (a) at the substation, (b) at the consumer's premises. **[4]**

4. A three-generator system is shown in Fig. 1. Find the impedances in per unit on the *100 MVA* and *11 kV* base. Also draw the impedance diagram for the same given that

$G_1 \rightarrow 100\,MVA, 11kV, x=25\% \parallel G_2 \rightarrow 150\,MVA, 16kV, x=10\% \parallel G_3 \rightarrow 200\,MVA, 21kV, x=15\%$

$T_1 \rightarrow 150\,MVA, 11/132kV, x=5\% \parallel T_2 \rightarrow 200\,MVA, 16/132kV, x=10\%$

$T_3 \rightarrow 250\,MVA, 21/132kV, x=5\% \parallel$ *Line* $L_1 \rightarrow 100\Omega \parallel$ *Line* $L_2 \rightarrow 50\Omega \parallel$ *Line* $L_3 \rightarrow 80\Omega$



[4]

Fig. 1

5. Compute the generation cost per *kWh* from the following data: Installed capacity = *200 MW*; Capital cost = *Rs. 3,000 per kW*; Interest and depreciation = *12%*; Fuel consumption = *0.9 kg/kWh*; Fuel cost = *Rs. 70 per 1,000 kg*; Other operating costs = *30%* of fuel costs; Load factor = *80%*; Peak load = *170 MW*. **[4]**

6. A plant costs *Rs.* 7.56×10^5 and it is estimated that after 25 years it will have to be replaced by a new one. At that instant its salvage value will be *Rs.* 1.56×10^5. Calculate

(i) annual deposit to be made in order to replace the plant after *25* years,

(ii) the value of plant after *10* years

on the following basis (a) straight line method, (b) diminishing value method, (c) sinking fund method. **[5]**