CODE NO : OR 310203 OR

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS

POWER SYSTEM - II

(ELECTRICAL & ELECTRONIC ENGINEERING)

/NAVEMBER 2005

TIME: 3 HOURS
MAX MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Clearly explain what you understand by GMR and GMD of a transmission line?

(b) What is equivalent spacing of a 3-phase line? What is its significance?

(c) Calculate the inductance of each conductor in a 3-phase, 3-wire system, when the conductors are arranged in a horizontal with spacing such that DRY =4 m; DY B=3 m; DBR=2m. The conductors are transposed and each has a diameter of 2.5 m. [6+4+6]

2. What is method of images? Derive an expression for the capacitance per unit length of a 3-phase transposed line. What is the effect of earth on the capacitance of the line? [16]

3. (a) Discuss why equivalent π circuit of a long line is preferred over the equivalent T circuit.

(b) A three phase 50 Hz transmission line is 150 km long and delivers 25 MW at 0.85 power factor lagging and at 110 KV. The resistance and reactance of the line per conductor per km are 0.3 ohms and 0.9 ohms respectively. The line charging admittance is 0.3×10-6 mho per km per phase. Compute by applying the nominal π method the voltage regulation and transmission efficiency. [5+11]

4. (a) Each conductor of a 33 KV, 3-phase system is suspended by a string of three similar insulators, the capacitance of each disc is nine times the capacitance to ground. Calculate the voltage across each insulator. Determine the string efficiency.

(b) A string of eight suspension insulators is to be graded to obtain uniform distribution of voltage across the string. If the capacitance of the top unit is 10 times the capacitance to ground of each unit, determine the capacitance of the remaining seven units. [8+8]

5. Calculate maximum sag of a line with copper conductor 7/0.295 cm size, are 0.484 sq.cm, overall diameter 0.889 cm, weight 428 kg/km and breaking strength 1,975 kg. Assume factor of safety 2. Span 200 metres. Level supports :

(a) Due to weight of the conductor

(b) Due to additional weight of ice loading of 1cm thickness

(c) Due to both a) and b) plus wind acting horizontally at a pressure of 39 kg per sq. metre.

[4+4+8]

6. (a) With a neat diagram, show the various parts of a high voltage single core cable.

(b) Find the diametral dimensions for the 1-core, metal-sheathed cable giving the greatest economy of insulating material for a working voltage of 85 kv, if a dielectric stress of 60 kv per cm can be allowed. *[8+8]*

7. (a) Why a consumer having low power factor is charged at higher rates?

(b) A consumer has an average demand of 400 KW at a p.f. of 0.8 (lag) and annual load factor of 60%. The tariff is Rs. 100/- per KVA of maximum demand per annum plus 120 paise per KWH. If the p.f. is improved to 0.95 (lag) by installing phase advancing equipment Calculate

i. the capacity of the phase advancing equipment

ii. the annual saving effected

The phase advancing equipment costs Rs. 150 per KVAR and the annual interest and depreciation together amount to 10%.

[10+3+3]

8. (a) A set of unbalanced vectors can be transformed into three sets of balanced components. Explain how this can be done using symmetrical components in detail.

(b) A system of unbalanced three phase voltages are given by 100V, +j200V and (-100-j160)V. Determine the three symmetrical components of the system. *[8+8]*