B.E. Fifth Semester (Electrical Engineering (Electronics & Power)) (C.B.S.)

# Electrical Power System - I

P. Pages : 3 **NKT/KS/17/7333**

Time : Three Hours * 0 0 1 1 * Max. Marks : 80

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Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

**1.** a) Explain the advantages and limitations of high and extra high voltage levels of transmissions. Give the range of voltages to distinguish clearly as HV, EHV & UHV levels. **7**

b) Draw the layout of 11KV/400V substation compare indoor and outdoor type of substation. **6**

**OR**

**2.** a) i) List the various equipments used in substation. **4**

ii) Compare HVDC & EHVAC system. **3**

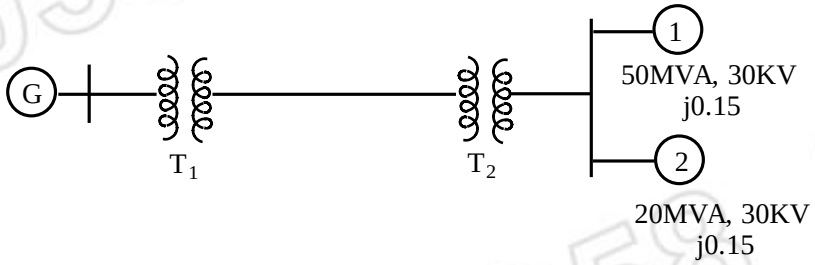
b) Write short notes on:

i) Complex power. **3**

ii) Voltage & frequency dependence of loads. **3**

**3.** a) Derive the relation for change of base from 1 system to another system. **6**

b) A 50MVA, 15KV three phase generator has a subtransient reactance of 0.20 per unit. The generator supplies two motor over a transmission line having transformers at both ends as show in fig. The Motors have rated inputs of 50MVA and 20 MVA, both 30KV with 0.15 per unit subtransient reactance. The rating of sending end transformer $T_1$ is 50MVA, 11/132 KV with leakage reactance of 0.10 per unit. The Transformer $T_2$ at the receiving end has a rating of 60MVA, 131.6/33KV with leakage reactance of 0.12 per unit. Series impedance of the line is (25+j75) ohms. Draw the impedance diagram with all impedances marked in per unit. Select generator rating as the base in the generator circuit. **7**




**OR**

**4.** a) What is meant by transposition. Draw transposition cycle for single circuit and double circuit. **6**

b) A multi-conductor single phase line has three conductor's a, b and C each of diameter 40mm for lead and two conductors d & e of diameter 80mm for return circuit as shown in fig. 4 (b) Find the inductance per unit length on each side of the line and total inductance of the line. **7**

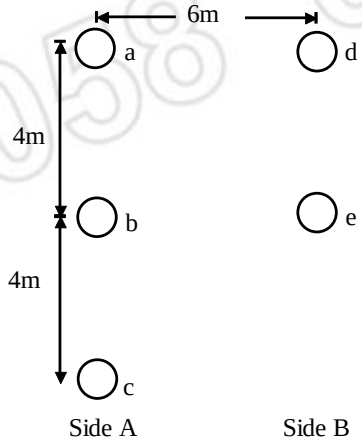



Fig. 4 (b)

**5.** a) Write a short note on:

i) Grading of cables. **3**

ii) Various components of distribution system. **3**

b) The test results for 1km of a $3-\phi$ metal sheathed belted cable gave a measured capacitance of $0.7\mu F$ between one conductor and the other two conductors bunched together with the earth sheath and $1.2\mu F$ measured between the three bunched conductors and the sheath find **7**

i) The capacitance between any pair of conductors, the sheath being isolated.
ii) The charging current when the cable is connected to 11KV, 50Hz supply.

**OR**

**6.** a) Discuss the significance of string efficiency. Prove that in a string of suspension insulator there is unequal distribution of voltage. **6**

b) A string of suspension insulators consist of four units. The capacitance between each link pin and earth is one-tenth of the self capacitance of a unit. The voltage between the line conductor and earth is 100KV. Find **7**

i) The voltage distribution across each unit. ii) String efficiency

**7.** a) Discuss about the various transmission lines of a system? With the help of phasor diagram derive generalized constants for nominal-T circuit representation. **7**

b) 15000KVA is received at 33KV at 0.85 power factor lagging over an 8km there phase overhead line Each line has $R = 0.29\Omega/\text{km}$ and $x = 0.65\Omega/\text{km}$ Calculate **7**

a) The voltage at the sending end
b) The power factor at the sending end
c) The regulation and
d) The efficiency of the transmission line.

**OR**

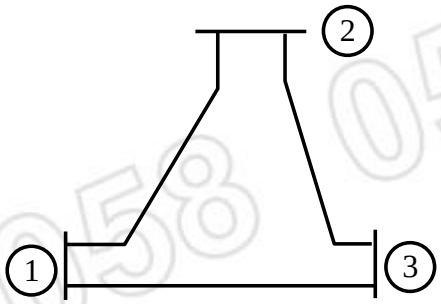
**8.** a) Using rigorous method, derive an expression for sending end voltage & current for long transmission line. **7**

b) A three-phase, 50Hz, 150km line operates at 110KV between the lines at the sending end. The total inductance and capacitance per phase are 0.2H and 1.5μF Neglecting losses, calculate the value of receiving – end load current having a power factor of unity for which the voltage at the receiving end will be the same as that at the sending end. Assume one-half of the total capacitance of the line to be concentrated at each end. **7**

**9.** a) Classify the various types of buses in power system for load flow study and explain their characteristics. **6**

b) Determine $y_{bus}$ for the 3-bus system shown in fig. The line series impedances are as follows: **7**

| line (bus to bus) | Impedance (pu) |
|---|---|
| 1 - 2 | 0.06 + j 0.18 |
| 2 - 3 | 0.08 + j 0.24 |
| 1 - 3 | 0.03 + j 0.09 |




**OR**

**10.** a) Write a short note on frequency and voltage as a system state indicators. **7**

b) Discuss the important characteristics of static load flow equations. **6**

**11.** a) Two alternators rated 200MW & 400MW are operating in parallel. Governors setting on the machine are such that they have 4% & 5% droop respectively from no load to full load. Determine load taken by each generator for a total load of 600MW & system frequency at this total load if no load frequency is 50Hz. **7**

b) Explain in brief the principle of working of speed governing system for a turbo generator. **7**

**OR**

**12.** Write short notes on:

a) Automatic voltage regulator for turbo generators. **5**

b) Concept of real and reactive power control. **4**

c) Reactive power sharing between two parallel alternators. **5**

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