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RAMAIAH
Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – MARCH 2022

Program	:	**B.E.: Electrical and Electronics Engineering**	**Semester**	:	**V**
Course Name	:	**Power System Engineering - I**	**Max. Marks**	:	**100**
Course Code	:	**EE53**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT- I

1. a) Briefly discuss the different types of supporting structures, which are used for overhead lines. CO1 (05)

   b) What are the advantages and difficulties of high voltage DC transmission for long distances. CO1 (05)

   c) Calculate maximum sag(total and vertical) of a line with the copper conductor 7/0.295 size, area 0.484 sq.cms, overall dia. 0.889 cms, weight 428 kg/km and breaking strength 1,973 kg. assume factor of safety 2. Span 200 meters. Level supports- CO1 (10)
      i) Due to weight of the conductor.
      ii) Due to additional weight of ice loading of 1 cm thickness.
      iii) Due to both (i) and (ii) plus wind acting horizontally at a pressure of 39 kg per sq. Meter.
      (consider weight of ice is 913.5 kg/m^3).

2. a) Write a neat sketch explaining about the typical transmission and distribution system. CO1 (05)

   b) List out the advantages of high voltage transmission in terms of volume of the conductor, material required, transmission efficiency and percentage line drop. CO1 (05)

   c) An overhead line with a span of 300 m and in a hilly area with uniform ground slope of 1 in 20 and having a conductor weight of 0.8 kg/m, is supported between two towers at equal height of 30 m above the ground level. Assuming the horizontal component of tension in the line to be 1500kg; find: CO1 (10)
      i) The clearance at the point where conductor has its lowest elevation.
      ii) The minimum clearance of the line from ground.

UNIT – II

3. a) Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31} = 4 m; D_{12} = D_{23} = 2m. The conductors are transposed and have a diameter of 2·5 cm. CO2 (07)

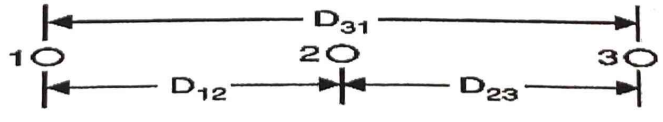

Fig. 3(a)

   b) Why do you find line to neutral capacitance in a three phase system? Explain. CO2 (05)

   c) List the methods to improve string efficiency? Briefly explain each one of them. CO4 (08)

4. a) A single 3-phase line operated at 50Hz is arranged as equilaterally spaced with 2m, 2m and 3m sides. The conductor diameter is 0.6 cm. Find the inductance and capacitance per/km. The line is regularly transposed. CO2 (08)

   b) Each of the three insulators forming a string has a self capacitance of C farads. The shunting capacitance between earth and metal work of each insulator is 0.18 C while it is 0.1 C between metal work and line. Calculate the voltage across each insulator as a percentage of the line conductor voltage to earth and the string efficiency.
   Now a guard ring is provided, increasing the capacitance to the line of the metal work of the lowest unit to 0.25 C. Calculate the new string efficiency and redistribution of the voltage. CO4 (12)

UNIT – III

5. a) A three phase 50 Hz transmission line 100 km long has the following constants: resistance/ph/km=0.1 Ω, inductive reactance/ph/km = 0.2 Ω, capacitive reactance/ph/km=4 μmho. The line is supplying a balanced load of 10 MW, 0.8 lagging pf at 66 kV. Using nominal - T method, Determine (i) sending end voltage, (ii) sending end power factor, (iii) if the load is thrown off, calculate new receiving voltage. CO2 (08)

   b) If a long transmission line is open circuited at the receiving end, will there be any current in the line at the sending end. Justify your answer. CO2 (06)

   c) Prove that the per unit impedance of a transformer is same when referred to its primary and secondary sides. CO5 (06)

6. a) A balanced three phase load of 30 MW is supplied at 132 kV, 50Hz and 0.85 pf lagging through a transmission line. The series impedance of single conductor is (20+j52) Ω. And the total phase neutral admittance is 315 μmhos. Using nominal- л method, determine (i) ABCD constants of the line, (ii) line regulation. CO2 (08)

   b) A single core lead sheathed cable has a conductor diameter of 3 cm; the diameter of the cable is 9 cm. the cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively with corresponding safe working stresses of 30 kV/cm and 20 kV/cm. calculate the radial thickness of each insulation and the safe working voltage of the cable. CO4 (08)

   c) State the assumptions of deriving reactance diagram when represented in per unit. CO5 (04)

UNIT – IV

7. a) In a three phase- 4 wire system, the currents in R, Y and B lines under unbalanced condition are given as:
   I_R=(86.6+j50) A, I_Y=(25-j43.3) A and I_B=(-30+j0)
   Calculate the positive, negative and zero sequence currents in the R phase and return current in the neutral wire. CO6 (08)

   b) Obtain the zero sequence circuit of the following transformer configurations:
   (Y-Y), (Yg-Y),(Yg-Yg), (Yg-D), (D-D), (D-Yg) and (Y-D). Also mention the configurations which carries zero sequence current. CO6 (12)

8. a) The zero and positive sequence components of R phase are given as V_{R0}=(0.5-j0.866) V, V_{R1}=(2+j0) V. If the phase voltage V_Y=(3+j0) V, find the negative sequence of R phase and phase voltage of V_Y and V_B. CO6 (08)

b) Draw the zero sequence network for the given system. CO6 (12)
G: 300MVA, 20 kV, X0=0.06pu Xn=0.5 Ω
M1: 13.2 kV, 200 MVA, X0=0.06pu, Xn=0.5 Ω
M2: 13.2 kV, 100 MVA, X0=0.06pu
T1: 400 MVA, 230 kV/20 kV, 10% leakage reactance
T2: three single phase transformer each rated at 127/13.2 kV, 100 MVA, 10 % leakage reactance.
Line: 100 km long, zero reactance is 1.2 Ω/km.

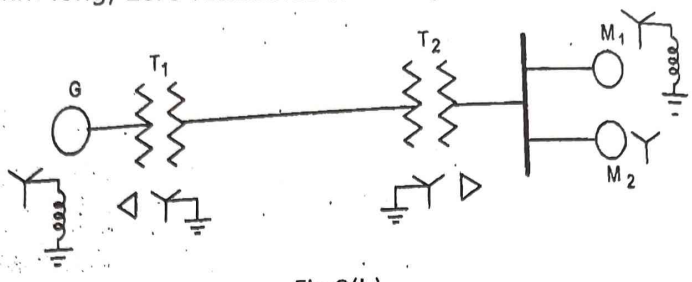

Fig.8(b)

UNIT – V

9. a) With necessary diagram explain DC distributor with uniformly distributed loads fed at both end which are maintained at unequal voltages. Also derive the equation for voltage drop at different points for the chosen system. CO5 (10)

b) With the help of a phasor diagram discuss the Ac distribution when power factors referred to receiving end voltage. CO5 (06)

c) Why balancer in 3 wire DC distribution is used? CO5 (04)

10. a) Write short notes on the influence of voltage on the size of a feeder and a distributor. CO5 (06)

b) A distributor AB is fed from both ends as shown in Fig.10(b) the loop resistance of the distributor is 0.5 ohm/km. calculate the minimum voltage and its location and currents in various sections of (i) voltage at A and B are equal to 230 volt, (ii) voltage at point A is 230 volt and at B it is 234 volt. CO5 (10)

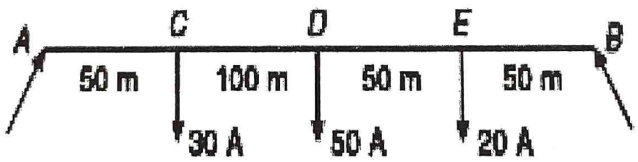

Fig.10(b)

c) Write short notes on ring main distributors. CO5 (04)

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