R16

Code No: 135BJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, December - 2019

POWER SYSTEMS - II

(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

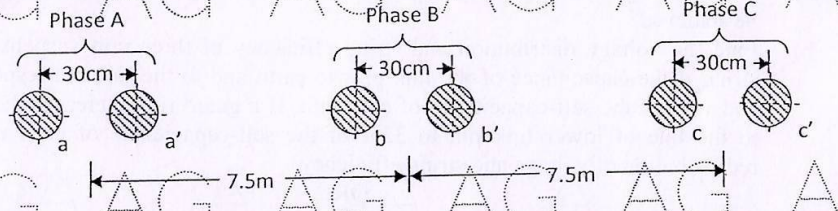
Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A **(25 Marks)**

1.a) Define GMR. [2]
b) Discuss the advantages of bundled conductors, when used for overhead lines. [3]
c) Define Surge Impedance loading. [2]
d) Draw the equivalent Pi model for long transmission line. [3]
e) What are the factors that cause a travelling wave? [2]
f) How proximity effect influences the performance of transmission line. [3]
g) Classify transmission line insulators. [2]
h) List the factors that affect the sag in transmission lines. [3]
i) Write the expression for insulation resistance of a cable. [2]
j) State the classification of cables according to voltage. [3]

PART - B **(50 Marks)**

2.a) Derive an expression for the loop inductance of a single-phase, two-wire (solid) system from the fundamentals.
b) Calculate the inductance per phase per km length of the system of conductors shown in the figure below. Self-GMD of one conductor is 0.8cm. Assume line is regularly transposed. [4+6]



OR

3.a) Derive the capacitance per kilometer to neutral of a 3-phase overhead transmission line with unsymmetrical spacing of conductors assuming transposition.
b) Calculate the capacitance of a conductor per phase of a three-phase 400 km long line, with the conductors spaced at the corners of an equilateral triangle of side 4 m and the diameter of each conductor being 2.5cm. [6+4]

4.a) Deduce expressions for ABCD constants of a long transmission line in terms of its parameters.

b) Calculate ABCD constants of a 3-phase, 80Km, 50 Hz transmission line with series impedance of (0.15+j0.78) Ohm/Km and a shunt admittance of $j5.0 \times 10^{-6}$ mho/Km. [6+4]

OR

5.a) Derive the expressions for regulation and transmission efficiency for medium length transmission lines using nominal - π method and illustrate your answer with suitable phasor diagram.

b) The parameters of a 3-phase 215kV, 60Hz, 400km long transmission line are $y = j3.2 \times 10^{-6}$ mhos/km/phase and $z = (0.1 + j\ 0.5)$ ohm/km/phase. The line supplies a 150 MW load at unity power factor. Determine [5+5]
i) The voltage regulation
ii) The sending-end power and
iii) The efficiency of transmission.

6.a) A 400m long cable is short-circuited at the remote end. A pulse-source, having resistance of 150 Ohms, drives a 100V pulse having duration of 6μs. If the characteristic resistance of the cable is 50 Ohms and the pulse velocity is 200m/μs, sketch the voltage profile for first 8μs at the input of the line.

b) What is meant by the disruptive critical voltage and visual critical voltage? How conductor size, spacing and condition of the surface of conductors effect disruptive critical voltage and visual critical voltages. [6+4]

OR

7.a) Explain the phenomena of attenuation on transmission lines.

b) A 110 kV, 3 Phase, 50 Hz transmission line, 175 km long consists of three 1 cm diameter stranded copper conductors spaced in 3 m delta arrangement. Temperature taken at 26^0C and barometric pressure as 74 cm. Assume surface irregularity factor m= 0.85 (Roughness factor). Find [3+7]
i) Disruptive voltage
ii) Visual corona voltage
iii) Power loss due to corona.

8.a) Define string efficiency. Why is it necessary to have high string efficiency? How can it be achieved?

b) Find the voltage distribution and string efficiency of three unit suspension insulator string if the capacitance of the link pins to earth and to the line are respectively 20% and 10% of the self-capacitance of each unit. If a guard ring increases the capacitance to the line of lower link pin to 35% of the self-capacitance of each unit, find the redistribution of voltage and string efficiency. [5+5]

OR

9.a) What is sag template? Where it is used?

b) An overhead transmission line has a span of 220 meters, the conductor weighing 804 kg/km. Calculate the maximum sag if the ultimate tensile strength of the conductor is 5,758 kg. Assume a safety factor of 2. [4+6]

10.a) Show that for the same dimensions of a cable with an intersheath can withstand a working voltage of 33% higher than a non-intersheath cable. Assume same homogeneous dielectric and most economical designs for both cables.

b) Determine the thickness of insulation and operating voltage of a single core cable if the maximum and minimum stress in the dielectric is 38 kV/cm (r.m.s) and 12 kV/cm (r.m.s) respectively and the diameter of core is 3 cm. [5+5]

OR

11.a) Derive the condition for the most economical size of conductor in a single-core cable.

b) A 66kV concentric cable with two inter sheaths has a core diameter 1.8 cm. Dielectric material 3.5 mm thick constitutes the three zones of insulation. Determine the maximum stress in each of the three layers if 20kV is maintained across each of the inner two layers. [4+6]

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