Code No: 135BJ **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 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.

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PART - A

(25 Marks)

1.a) What are the properties of conducting material. [2]
b) What is the need of double circuit transmission line? [3]
c) How do you classify the transmission line is to short, medium and long lines. [2]
d) What are the methods used for computing the hyperbolic functions in the solution of long lines? [3]
e) What is Ferranti effect? [2]
f) What are the factors affecting the skin effect? [3]
g) What are the types of insulators? [2]
h) What are the disadvantages of loose span? [3]
i) What are the necessary requirements for cables? [2]
j) What is meant by grading of cables? [3]

PART - B

(50 Marks)

2.a) What do you understand by transposition of lines? What is its effect on the performance of the line?
b) A 3-ϕ, 50Hz over head high tension line (HTL) has each conductor of 3cm diameter. The distance between 3-phases are between A and B is 6m, B and C is 5m and C and A is 4m. Calculate the inductance of each line. If the lines are transposed regularly, determine the inductance per km. [5+5]

OR

3.a) What is equivalent spacing of a 3-phase line? What is its significance?
b) The conductors in a single phase transmission line are 6m above the ground. Taking the effect of the earth into account. Calculate the capacitance/km. Each conductor is 1.5cm diameter and the conductors are spaced 3m apart. [5+5]

4.a) Draw the phasor diagram of a short transmission line and derive an expression for voltage regulation.
b) A 3- phase transmission line is 480km long and serves a load of 400MVA, 0.8p.f lag at 345kV. The ABCD constants of the line are $A=D=0.818\angle 1.3^0$; $B=172.2\angle 84.2^0$; $C=0.001933\angle 90.4^0$ mhos. i) Determine the sending end line to neutral voltage, the sending end current and the percent voltage drop at full load. ii) Determine the receiving end line to neutral voltage at no load, the sending end current at load and the voltage regulation. [4+6]

OR

5.a) Starting from first principles deduce expressions for ABCD constants of a long line in terms of its parameters.

b) An overhead single phase line delivers 1.1MW at 33 kV at 0.9 p.f lagging. The total resistance of the line is 10Ω and the total inductive reactance is 15Ω. Determine (i) %voltage regulation, (ii) sending end power factor and (iii) transmission efficiency. [5+5]

6.a) Discuss the phenomenon of wave reflection and refraction. Derive expression for reflection and refraction coefficients for open circuit and short circuit lines.

b) An overhead transmission line operates at 220 kV between phases at 50 Hz. The conductors are arranged in a 4 meters delta formation. What is the maximum diameter of conductor that can be used for no corona loss under fair weather conditions? Assume an air density factor of 0.95 and irregularity factor of 0.85. The critical voltage is 230 kV. Find also the power loss under stormy conditions. [5+5]

OR

7.a) What are the disadvantages of corona? Explain how the corona considerations effect the design of a line?

b) A 200 kV surge travels on a transmission line 400 ohms surge impedance and reaches a junction where two branch lines of surge impedances of 500 ohms and 300 ohms are connected with the transmission line. Find the surge voltage and current transmitted into each branch line. Also find the reflected voltage and current. [5+5]

8.a) What electrical and mechanical characteristics are required for a good insulator for using in HV transmission lines?

b) A transmission line conductor having a diameter of 19.5 mm weighs 0.85 kg/m. The span is 275 meters. The wind pressure is 40 kg/m^2 of projected area with ice coating 13 mm. The ultimate strength of the conductor is 8000 kg. Calculate the maximum sag, if the factor of safety is 2 and ice weighs 910 kg/m^3? [5+5]

OR

9.a) Derive the expression for sag and tension when the supports are at unequal heights.

b) A string has 5-suspension discs. The capacitance between each unit and earth is 1/5th of the mutual capacitance. (i) Find the voltages across different discs as percent of total string voltage, (ii) also find the string efficiency. [5+5]

10.a) What are the limitations of solid type cables? Explain any other kind of cable to overcome the limitations.

b) A single core lead covered cable is to be designed for 100 kV to earth. Its conductor radius is 0.5 cm and three insulating materials having relative permittivity's of 4.5, 3.0 and 2.5 with maximum permissible stress of 50, 40 and 30 kV/cm respectively. Determine the internal diameter of lead sheath. [5+5]

OR

11.a) Describe with a neat sketch the construction of 3-core belted type cable. Discuss the limitations of such a cable.

b) A cable has been insulated with two insulating materials having permittivity's of 6 and 4 respectively. The inner and outer diameters of a cable are 3 cm and 7 cm. The dielectric stresses of 58 kV/cm and 28 kV/cm. calculate the radial thickness of each insulating layer and the safe working voltage of the cable. [5+5]

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