CBCS SCHEME

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18EPS241

Second Semester M.Tech. Degree Examination, June/July 2019
EHV AC Transmission

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Illustrate the method of calculation of capacitance of multi conductor transmission line. Show that the product of line capacitance and line inductance is inversely proportional to the square of the velocity of light. **(08 Marks)**

b. A power of 2000MW is to be transmitted from a grid station to a load centre situated at a distance of 800km. Compute the number of circuits of 750kV class lines required if the line is provided with 50% series compensation. Also determine the total power loss and loss per km. Assume line series reactance and resistance as 0.272Ω/km and 0.0136 Ω/km respectively $\delta = 30°$. **(06 Marks)**

c. Describe: i) Aeolian vibration ii) Galloping. **(06 Marks)**

OR

2 a. Describe the power handling capacity and percentage power loss of an EHV transmission line. **(06 Marks)**

b. Define Geometric Mean Radius (GMR) of a bundle conductor. If N is the number of subconductors in the bundle, r is the radius of subconductor and R is the bundle radius, show that $GMR = (N \cdot r \cdot R^{N-1})^{1/N}$ **(08 Marks)**

c. Explain in detail the transformation of phase quantities like self and mutual inductances and capacitance of 3 phase line into sequence quantities **(06 Marks)**

Module-2

3 a. Develop the equations for electric field, potential and potential difference in the vicinity of a line conductor. **(06 Marks)**

b. Discuss how cylindrical cages are used for corona studies. **(04 Marks)**

c. Using charge potential relationship of a multi conductor line, identify the maximum charge condition on a 3 phase single circuit transmission line. **(10 Marks)**

OR

4 a. Examine that the surface voltage gradient on subconductor of a two conductor bundle that follows cosine law. Mention the assumptions made. **(10 Marks)**

b. A conductor of 5cm diameter is strung inside an outer cylinder such that its capacitance per unit length is 12.68×10^{-12} F/M. Calculate the radius of the outer cylinder, corona inception gradient, corona inception voltage, grading factor and characteristic impedance. **(10 Marks)**

Module-3

5 a. With typical example, discuss corona power loss in EHV transmission line and compare with I^2R loss. Show with the help of waveforms that the corona current is pulsative in nature. **(10 Marks)**

b. Compare I^2R loss and corona power loss as calculated by Peek's formula of a 420KV, 400km, 50Hz transmission line given lead angle = 30° load power factor = 0.85, positive sequence reactance = 0.327 Ω/km, resistance = 0.031 Ω/km air density factor =1, radius of conductor being 1cm and strung at a height of 5 meters. **(10 Marks)**

OR

6 a. Discuss the double-exponential response of an open-ended transmission line for an excitation function $e(t) = E_0 (e^{-\alpha t} - e^{-\beta t})$. **(10 Marks)**

b. Illustrate the principle of travelling wave protection of EHV lines. **(10 Marks)**

Module-4

7 a. Describe with suitable diagram, the lighting stroke mechanism as applied to EHV transmission line and explain how the crest current and front time of the lighting current are estimated. **(10 Marks)**

b. Using symmetrical component theory, formulate an expression for the earthing coefficient for a 3-phase system with terminal single phase-to-ground fault. **(10 Marks)**

OR

8 a. Describe the operating characteristics of gap type silicon carbide and gap less Zinc oxide surge arresters. **(10 Marks)**

b. Discuss the methods/measures adopted to reduce overvoltage magnitudes in EHV system. **(10 Marks)**

Module-5

9 a. Explain the significance of generalized constants of a transmission line. **(04 Marks)**

b. Define sub synchronous resonance. Show that the electrical resonant frequency of a series compensated line is $f_e = f_o\sqrt{m}$; where f_o is power frequency and m is degree of compensation. **(06 Marks)**

c. Discuss the insulation characteristics of rod plane gap used in the selection of various line insulation. **(10 Marks)**

OR

10 a. Formulate expressions for steady state voltage and current of a distributed parameter transmission line at its entrance in terms of voltage and current at the load end. Neglecting resistance, also formulate expressions for attenuation constant, surge impedance and phase shift constant. **(12 Marks)**

b. What is synchronous condenser in power system operation? Using circle diagram of a transmission line estimate the rating of the synchronous phase modifier. **(08 Marks)**

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