Code No: R2031021 **R20** SET - 1

III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23
POWER SYSTEMS - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the inductance of 2-wire transmission line [7M]
   b) Derive the expression for capacitance of three phase transmission line with asymmetrical spacing [7M]

(OR)

2. a) A single phase, two wire transmission line 20km long, is made up of round conductors each 0.9cm in diameter, separated from each other by 45cm. Calculate the equivalent diameter of a fictitious hollow, thin-walled conductor having the same inductance as the original line. What is the value of this inductance? [7M]
   b) Discuss the concept of geometric mean distance. How is this concept used to find the inductance of composite conductor line? [7M]

UNIT-II

3. a) Derive the A, B, C and D constants for Nominal-T model [7M]
   b) A single-phase overhead transmission line is transmitting 1200kW power to factory at 11kV at 0.8 P.F lag. The line resistance and loop reactance of the line are 3 ohm and 5 ohm per phase. Determine i) Source voltage ii) Percentage regulation iii) Efficiency. [7M]

(OR)

4. a) What is an equivalent Π circuit model of long line? Derive expression for parameters of this circuit in terms of line parameters. [7M]
   b) Determine the auxiliary constants of a 3-phase, 50Hz, 200km long transmission line having resistance, inductance and capacitance per phase per km of 0.15 ohm, 3.5mH and 0.009μF respectively. [7M]

UNIT-III

5. a) Discuss the propagation of surges in transmission lines. [7M]
   b) A cable with surge impedance of 100 Ohms is terminated in two parallel connected open wires having surge impedances of 600 Ohms, and 1000 Ohms respectively. If a steep fronted voltage wave of 2 kV travels along the cable, find the voltage and current in the cable and the open-wire lines immediately after the travelling wave has reached the transition point. Assume voltage wave to be infinite length. [7M]

(OR)

6. a) Deduce expression for velocity of propagation of travelling waves. [7M]
   b) How the travelling waves are attenuated, describe numerically?. [7M]

UNIT-IV

7. a) Explain the concept of corona in transmission system. [7M]
   b) The corona loss on a particular system at 50 Hz is 1 kW/km per phase. Calculate the corona loss at 60 Hz for the same system. [7M]

(OR)

8. a) Justify the sentence. "Corona loss doesn't depend on height of the conductor" [7M]
   b) Write the formula to calculate corona loss and explain each term in it. Also, explain the factors that affects corona loss. [7M]

UNIT-V

9. a) What is a sag-template? Explain how this is useful for location of towers and stringing of power conductors. [7M]
   b) A string of suspension insulators consists of 5 units each having capacitance C. The capacitance between each unit and earth is 1/8 of C. Determine the voltage distribution across each insulator in the string as a percentage of voltage of conductor to earth. If the insulators in the string are designed to withstand 36 kV maximum, calculate the operating voltage of the line where 5 suspension insulator strings can be used. [7M]

(OR)

10. a) What is guard ring which is being used in the suspension string type insulator? Deduce the relation for determining the capacitance formed by the ring. [7M]
    b) Each line of a three-phase system is suspended by a string of 3 identical insulators of self-capacitance C farad. The shunt capacitance of the connecting metal work of each insulator is 0.3C to earth and 0.2C to line. Calculate the string efficiency of the system if the guard ring increases the capacitance to the line of the metal work of the lowest insulator to 0.35C. [7M]

Code No: R2031021 **R20** SET - 2

III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23
POWER SYSTEMS - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) In a 3-phase transmission line the 3 conductors are place at the corners of a triangle of sides 2m, 3m and 2.5m. If the diameter of each conductor is 1.6cm and conductors are regularly transposed, calculate the inductance per phase per kilometre. [7M]
   b) Discuss the effect of bundling on capacitance of transmission lines [7M]

(OR)

2. a) Briefly discuss the various types of conductor material used for overhead transmission lines. [7M]
   b) A 3-phase, 50 Hz, 66 kV overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 3m sides and the diameter of each conductor is 1.5 cm. Determine the capacitance per phase, if the length of line is 100 km. And also calculate the charging current. [7M]

UNIT-II

3. a) A single-phase overhead transmission line is delivering 600kVA load at 2kV. It's resistance and reactance are 0.18 ohm and 0.36 ohm per phase. Determine the voltage regulation if the load power factor is i) 0.8 P.F lag ii) 0.8 P.F lead. [7M]
   b) Derive the A, B, C and D constants of long transmission lines using Rigorous solution. [7M]

(OR)

4. a) Explain surge impedance loading [7M]
   b) A balanced 3-phase load of 30 MW is supplied at 132 kV, 50 Hz and 0·85 p.f. lagging by means of a transmission line. The series impedance of a single conductor is (20 + j52) ohms and the total phase-neutral admittance is 315×10^{-6} siemens. Using nominal T method, determine: (i) the A, B, C and D constants of the line (ii) sending end voltage (iii) regulation of the line. [7M]

UNIT-III

5. a) Explain about termination of line with open circuit for travelling wave. [7M]
   b) An overhead transmission line with surge impedance 400 ohms is 300 km long. One end of this line is short circuited and at the other end a source of 11 kV is suddenly switched in. Calculate the current at the source end 0.005 sec after the voltage is applied. [7M]

(OR)

6. a) What is a travelling wave? Explain the development of such a wave on an overhead line. [7M]
   b) Derive the expressions for reflected voltage and current waves, when the transmission line is terminated by the capacitive load. [7M]

UNIT-IV

7. a) Write the formula to calculate critical voltage and explain each term in it. Also, explain the factors that affects critical voltage. [7M]
   b) Explain the methods to minimize the effect of corona on transmission system. [7M]

(OR)

8. a) List and explain the advantages of corona effect. [7M]
   b) Explain the effect of atmospheric factors on corona occurrence. [7M]

UNIT-V

9. a) What is a stringing chart? Explain its application. [7M]
   b) A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 metres above water level. The horizontal distance between the towers is 300 metres. If the tension in the conductor is 2000Kg, find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per metre = 0.844Kg. Assume that the conductor takes the shape of parabolic curve. [7M]

(OR)

10. a) With neat sketch explain about suspension type and strain type insulators. [7M]
    b) Determine the maximum sag of an overhead line conductor having a diameter of 19mm weighs 0.85 kg/m. The span length is 250 meters; wind pressure is 40 kg/m^2 of projected area with ice coating of 13 mm. The ultimate strength of the conductor is 8000 kg, the factor of safety is 2 and ice weighs 910 kg/m^3. [7M]

Code No: R2031021 **R20** SET - 3

III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23
POWER SYSTEMS - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the capacitance of single phase two wire line. [7M]
   b) Derive the expression for inductance of three phase transmission line with symmetrical spacing. [7M]

(OR)

2. a) What are bundled conductors? Discuss the advantages of bundled conductors, when used for overhead lines. [7M]
   b) What is method of images? Derive an expression for the capacitance per unit length of a 3-phase transposed line. What is the effect of earth on the capacitance of the line? [7M]

UNIT-II

3. a) A 3 phase, 50Hz, 100km long transmission line delivers a load of 20000KW at 110KV at 0.9 power factor lagging. The copper conductors of the line are 1.2 cm in diameter and are spaced equilaterally, so that the distance between them is 2 m. Using nominal Π method, calculate the sending end voltage, current, power factor, regulation and efficiency of the line. Neglect the leakage. [7M]
   b) Derive the ABCD parameters of a nominal π represented medium length transmission line with neat phasor diagram. [7M]

(OR)

4. a) Derive the expressions for regulation and efficiency of a short transmission line. Draw required circuit and phasor diagram. [7M]
   b) An overhead 1-phase transmission line delivers a load of 1.5kW at 33kV at 0.9 p.f. lagging. The total resistance and inductance of the overhead transmission line is 8 Ohm and 15 Ohm respectively. Determine the following: [7M]
   i) Percentage of voltage regulation
   ii) Sending end power factor
   iii) Transmission efficiency

UNIT-III

5. a) Derive an expression for travelling wave in a power system [7M]
   b) A surge of 220 KV travelling on a line of surge impedance 400 ohms reaches a junction of the line with two branch lines of surge impedance 600 and 500 ohms respectively. Find the surge voltage and current transmitted into each branch line. Also find the reflected surge voltage and current. [7M]

(OR)

6. a) Show that surges behave as travelling waves. Derive expressions for surge impedance and wave velocity. [7M]
   b) Derive the expressions for reflected voltage and current waves, when the transmission line is terminated by the inductive load. [7M]

|''|''|||''|'''|||'|

UNIT-IV

7. a) Explain and write the expressions for critical disruptive voltage and visual critical voltage in detail. [7M]
   b) List and explain the disadvantages of corona effect. [7M]

(OR)

8. a) An equally spaced 3-phase transmission line has a total corona loss of 30 kW at 112kV, 50 Hz. Find the corona losses when the frequency is changed to 60 Hz. [7M]
   b) Explain the effect of using bundled conductors on critical voltage in the formation of corona. [7M]

UNIT-V

9. a) What is a stringing chart? Explain clearly the procedure adopted for stringing the power conductors on the supports. [7M]
   b) A transmission line conductor with diameter 14.5 mm, cross-sectional area of 125 mm^2 weighing 1118 kg/km has a span of 200 meters. The supporting structures being level. The conductor has an ultimate tensile stress of 42 kg/mm^2 and allowable tension is not to exceed $¼^{th}$ of ultimate strength. Determine the following [7M]
   i) Sag in still air.
   ii) Sag with a wind pressure of 60 kg/m^2 and an ice coating of 10 mm.
   Also calculate the vertical sag under this condition. Assume density of ice as 0.915 gm/c.c.

(OR)

10. a) Explain why the potential distribution is not, in general, uniform over the string in a suspension type of insulators. [7M]
   b) For a overhead line span length is 180m, difference in levels of supports is 7m, conductor diameter 2cm, weight per unit length of conductor 2 kg and wind pressure of 45 kg/m^2 of projected area. If the maximum tensile strength of the conductor is 4500 kg/cm^2 and safety factor 5, calculate the sag. [7M]

Code No: R2031021 **R20** SET - 4

III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23
POWER SYSTEMS - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Derive the capacitance of 3 phase symmetrical transmission line [7M]
   b) A single phase, two wire transmission line 20km long, is made up of round conductors each 0.9cm in diameter, separated from each other by 45cm. Calculate the equivalent diameter of a fictitious hollow, thin-walled conductor having the same inductance as the original line. What is the value of this inductance? [7M]

(OR)

2. a) In a 3-phase transmission line the three conductors are placed at the corners of a triangle of sides 1.5m, 3m, and 2.6m respectively. If the diameter of each conductor is 1.4 cm and the conductors are regularly transposed, calculate the inductance/phase/km length of the line. [7M]
   b) What factors must be taken into account while calculating the resistance of overhead line conductors. How are these factors account for? [7M]

UNIT-II

3. a) What is an equivalent Π circuit model of long line? Derive expression for parameters of this circuit in terms of line parameters. [7M]
   b) A three –phase, 220 kV, 50 Hz transmission line supplies a power of 100 MW at a power factor of 0.8 lagging at the receiving end. The series resistance, series reactance and shunt susceptance per phase per km are 0.08 Ω, 0.8 Ω, and 6×10^{-6} mho respectively. Consider four possible transmission lengths of 60, 200, 300 and 500 km. Find out the efficiency and regulation in each case. Also find the reactive power at the sending end and the reactive power absorbed by line [7M]

(OR)

4. a) Explain the influence of power factor on the performance of a transmission line. [7M]
   b) A 3-phase, 50 Hz, 150 Km long line has a resistance, inductive reactance and shunt capacitive admittance of 0.1 Ohm, 0.5 Ohm, and 3×10^{-6} Mho/Km/phase. If the line delivers 50 MW at 110 KV and 0.8 pf lagging. Determine the sending end voltage and current. Assume nominal π model for the line. [7M]

UNIT-III

5. a) Explain about travelling or propagation of surges and derive the mathematical expression for it. [7M]
   b) What are the specifications of a travelling wave? [7M]

(OR)

6. a) Derive the expressions for reflected voltage and current waves, when the transmission line is terminated by capacitive load. [7M]
   b) What are the types of power system transients? [7M]

UNIT-IV

7. a) Justify the sentence. "The charging current in a transmission line increases due to corona effect" [7M]
   b) Differentiate critical disruptive voltage and visual critical voltage in corona. [7M]

(OR)

8. a) Explain the term "Corona loss". Explain the factors to minimize these losses in transmission system. [7M]
   b) Explain how power transmission will be maximum when corona losses are minimum [7M]

UNIT-V

9. a) With neat sketch explain about suspension type and strain type insulators. [7M]
   b) An overhead transmission line has a span of 220m, the conductor weighing 804 kg/km. Calculate the maximum sag if the ultimate tensile strength of the conductor is 5,758 kg. Assume safety factor 2. [7M]

(OR)

10. a) What are disadvantages of providing too much or too small sag in a transmission line? Name different types of line supports with their place of use. [7M]
    b) Derive the sag expression for a transmission line with the effect of ice covering and wind pressure. [7M]