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

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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
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UNIT-I

1. a) Compare the properties of stranded, transposed and bundled conductors used for the transmission network? [7M]
   b) For a 3 phase line with equilateral spacing, derive the expression for the capacitance? [7M]

(OR)

2. a) Derive the expression for the flux linkages within the non magnetic conductor for producing the necessary flux? [7M]
   b) A 3 phase 66kV, 50Hz over head line has ACSR conductors of equivalent copper area 1.2cm^2 and effective diameter of 35.6 mm, spaced equilaterally 7.6m apart. Calculate the line parameters, charging current and MVA? The resistivity of copper is $1.73*10^{-4}$ ohm-cm? [7M]

UNIT-II

3. a) Derive the expression for the percentage voltage regulation of a short transmission line by using Taylor series expansion? [7M]
   b) A 17 km long 3 phase overhead line delivers 7.4 MW at 11 kV at a power factor of 0.7 lagging. Line loss is 11% of the power delivered. Line inductance is 1.3mH per km per phase. Find the sending end voltage and regulation, power factor of the load to make the regulation zero, the value of capacitor to be connected at the receiving end to reduce regulation to zero? [7M]

(OR)

4. a) Obtain the rigorous solution of the equations derived for long transmission lines? [7M]
   b) A short overhead 3 phase transmission line delivers 5554 kW at 33 kV at 0.9 power factor lagging. The resistance and reactance of each conductor is 4.3 ohms and 6.7 ohms respectively. Calculate the sending end voltage, percentage regulation and transmission efficiency? [7M]

UNIT-III

5. a) Discuss in detail about the properties of power system transients in the transmission network? [7M]
   b) Analyze the reflection and refraction of a voltage wave travelling over a 'T' junction? [7M]

(OR)

6. a) Obtain the reflected and refracted voltage waves of a transmission line with open circuit at the receiving end? [7M]
   b) A voltage having crest value of 3100 kV is travelling on a 770 kV line. The protective level is 1600 kV. The surge impedance of the line is 287 ohms. Find the current in the line before reaching the arrester, the current through the arrester, the value of the arrester resistance for this condition and the reflected voltage? Also verify the reflection and refraction coefficients? [7M]

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UNIT-IV

7. a) Explain in detail about the critical disruptive voltage by deriving the relative density in the corona phenomenon? [7M]
   b) A 3 phase over head line consists of 3 conductors in equilateral formation with 2.55 m spacing. The conductor diameter is 1.12 cm and surface factor 'm' is 0.78. The air temperature and pressure are 22.4^0C and 74 cm of mercury. Calculate the visual critical corona voltage? [7M]

(OR)

8. a) List out and explain the factors upon which the corona loss will depend upon? [7M]
   b) Derive the expression and analyze the electrical stress of a single phase system? [7M]

UNIT-V

9. a) Discuss in detail about various factors that affect the sag in the over head lines? [7M]
   b) Derive the expressions of voltage distribution of suspension insulators having four numbers of units? [7M]

(OR)

10. a) A string of six suspension insulators is to be fitted with a guard ring. The peak to earth and peak to peak capacitance is 'C'. Find the values of line to peak capacitance in terms of 'C' to have uniform voltage distribution over the ring? [7M]
    b) Explain various properties and materials used for insulators used in the power lines? [7M]

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

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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) Compare the properties of solid, stranded and hallow conductors used for the transmission lines? [7M]
   b) For a 3 phase line with asymmetrical spacing, derive the expression for the capacitance? [7M]

(OR)

2. a) Derive the expression for the flux linkages outside the non magnetic conductor for producing the necessary flux? [7M]
   b) A 3 phase single circuit bundled conductor line with two sub conductors per phase has a horizontal spacing with 5.8 m between the centre lines of the adjacent phases. The distance between the sub conductors of each phase is 32.7cm and each sub conductor has a diameter of 2.22 cm. Determine the inductance per phase per kilometer? [7M]

UNIT-II

3. a) Derive the expression for the power factor of short transmission line from the maximum regulation condition? [7M]
   b) A short 3 phase transmission line connected to 66 kV generating station at the sending end is to supply a load of 11MW at 0.76 power factor lagging at 28kV at the receiving end. If the minimum transmission efficiency is to be 0.92, find the per phase values of line resistance and reactance? [7M]

(OR)

4. a) Define Ferranti effect and prove it in the transmission lines with relevant expressions? [7M]
   b) A short transmission line with an impedance of (7.9+j8.6) ohms/ph has sending end and receiving end voltages of 110 kV and 98 kV respectively for some receiving end load at a power factor of 0.8 lagging. Determine the power output and the sending end power factor? [7M]

UNIT-III

5. a) Derive the velocity of propagation of travelling wave and analyze the role of natural impedance? [7M]
   b) Derive the expression for the refracted voltage of a transmission wave over the 'T' junction point? [7M]

(OR)

6. a) Obtain the reflected and refracted voltage waves of a transmission line with short circuit at the receiving end? [7M]
   b) A 550 kV surge travels on an over head line of surge impedance 356 ohms toward its junction with a cable which has a surge impedance of 36 ohms. Calculate the transmitted voltage, transmitted current, reflected voltage and reflected current? [7M]

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UNIT-IV

7. a) Explain in detail about the critical disruptive voltage by deriving the critical intensity r.m.s value in the corona phenomenon? [7M]
   b) A 3 phase over head line has conductors of 27 mm diameter and arranged in the form of equilateral triangle. Assuming fair weather conditions, air density factor of 0.92 and irregularity factor of 0.98. Calculate the minimum spacing between conductors if disruptive critical voltage is not to exceed 220 kV between the lines? The break down strength of air is 34kV/cm (peak)? [7M]

(OR)

8. a) Derive and explain the visual critical voltage of single phase lines and for 3 phase lines? [7M]
   b) Obtain the condition for peak value of electric stress of a single phase system? [7M]

UNIT-V

9. a) By assuming the catenary curved conductor between two equal supports, estimate the ground clearance point? [7M]
   b) Define string efficiency of insulators and explain unit grading procedure to improve string efficiency? [7M]

(OR)

10. a) A string of suspension insulators consists of 3 units capacitance between each pin and earth is 14% of self capacitance of each unit. If the maximum peak voltage per unit is not to exceed 32 kV, calculate the greatest working voltage and string efficiency? [7M]
    b) Explain the properties of pin type insulators and write about its leakage resistance with neat diagram? [7M]

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

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
POWER SYSTEMS - II
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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 and explain the resistance of solid conductors with circuit diagram? [7M]
   b) A 3 phase 220 kV, 124 km, 50 Hz single circuit line has horizontal spacing with 3.8 m between adjacent conductors assuming conductors are transposed. The conductor diameter is 1.8 cm. Determine the line capacitance per phase and charging current per phase? [7M]

(OR)

2. a) Consider an array of conductors and derive the flux linkages of one conductor in that array? [7M]
   b) Derive and analyze the capacitance of single phase line with image charges? [7M]

UNIT-II

3. a) Obtain the sending voltage and sending end current matrix of nominal 'T' circuit transmission line? [7M]
   b) A three phase 50Hz 109km long over head line has the following line constants: resistance per phase per kilometer is 0.221 ohms, inductance per phase per kilometer is 1.88mH, capacitance per phase per kilometer is 0.00885micro farads. The line supplies a load of 22 MW at 0.8 power factor lagging at a line voltage of 132 kV at the receiving end. By using nominal 'π' representation find the sending end voltage, current, power factor, regulation and efficiency of the line? [7M]

(OR)

4. a) Define and discuss in detail about surge impedance and surge impedance loading of long transmission lines? [7M]
   b) Calculate the distance over which a load of 17000 kW at 0.7 lagging power factor can be delivered by a three transmission line having conductors each of resistance 2.7 ohms per kilometer. The voltage at the receiving end is to be 66 kV and the loss in the transmission be 7.7%? [7M]

UNIT-III

5. a) Derive the velocity of propagation of travelling wave and analyze the role of surge impedance? [7M]
   b) Derive the expressions of voltage reflections of transmission lines ended with inductance and capacitance? [7M]

(OR)

6. a) Derive and analyze the coefficient of refractions of voltage and current waves of a line terminated with resistance? [7M]
   b) A surge of 122kV travels on a line of surge impedance 512 ohms and reaches the junction of the line with two branch lines of surge impedances 414 ohms and 44 ohms. Calculate the reflected voltage, transmitted voltage and transmitted currents? [7M]

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UNIT-IV

7. a) Derive and analyze the phase value of critical disruptive voltage of a 3 phase line with equivalent spacing? [7M]
   b) Calculate the disruptive critical voltage and visual critical voltage for local and general corona for a 3 phase line consisting of 20mm diameter conductors spaced in a 6.4m delta configuration. The temperature is 22^0C, pressure is 72 cm of mercury, and surface factor is 0.86, irregularity factor for local visual corona 0.77 and irregularity factor for general visual corona 0.85? [7M]

(OR)

8. a) Discuss in detail about various factors and practical conditions affecting the corona loss? [7M]
   b) Elaborate the adverse effects of corona on the nearby communication lines by using examples and specifications? [7M]

UNIT-V

9. a) Explain in detail about various forces acting on the conductor between two equal supports and derive the equilibrium point? [7M]
   b) Draw the diagram and estimate the number of units of suspension insulators used for suitable voltage? [7M]

(OR)

10. a) Discuss in detail about the charts and templates used for the estimation of sag in the lines? [7M]
    b) Describe how the metal ring increases the capacitance between the metal fittings and the line of string insulators with circuit diagram? [7M]

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

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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Time: 3 hours Max. Marks: 70

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

UNIT-I

1. a) Draw the equivalent circuit of transmission line and explain the existence of various parameters? [7M]
   b) A 132 kV, 50 Hz, 276 km long 3 phase line has its conductors on the corners of a triangle with sides of 6.7m, 6.7m and 13.4m. The conductor radius is 1.99cm. Calculate per phase per km, capacitive reactance per phase, charging current and total charging mega volt amperes? [7M]

(OR)

2. a) Derive and analyze the inductance of single phase line having composite conductors? [7M]
   b) Derive and analyze the capacitance of three phase line with image charges? [7M]

UNIT-II

3. a) Obtain the sending voltage and sending end current matrix of nominal 'π' circuit transmission line? [7M]
   b) A three phase 174 km long high voltage line has Z= (15.3+j44.34) ohms and Y = (0+j1.338*10^{-3}) Siemens. Find the characteristic impedance, propagation constant and A, B, C, D constants of the line? [7M]

(OR)

4. a) Obtain the A, B, C, D constants of long transmission lines from the rigorous solution? [7M]
   b) A 3 phase 7.8 km transmission line having resistance of 0.8 ohms/km and inductance of 1.32mH/km is delivering power at 0.7 power factor lagging, the receiving end voltage is 30 kV, and sending end voltage is 32 kV, 50Hz. Calculate the line current, regulation and efficiency of the transmission line? [7M]

UNIT-III

5. a) Prove that the velocity of wave propagation in transmission lines is equal to 3*10^{8} m/s? [7M]
   b) A surge of 210 kV travelling on a line of surge impedance 362 ohms reaches a junction of the line with two branch lines of surge impedances 540 ohms and 310 ohms respectively. Determine the surge voltage and current transmitted into each branch line. Also calculate the reflected surge voltage and current? [7M]

(OR)

6. a) Derive and analyze the coefficient of reflection of voltage and current waves of a line terminated with resistance? [7M]
   b) Prove that the magnitude of attenuation of travelling waves depend on the parameters of the line? [7M]

UNIT-IV

7. a) Define critical disruptive voltage of a three phase line and derive the critical disruptive voltage expression per phase? [7M]
   b) Derive the expression for the electrical stress of two conductors having opposite charges separated by a distance of 'D' meters? [7M]

(OR)

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8. a) What is meant by radio interference? Relate the corona loss with the radio interference by quoting the examples? [7M]
   b) Determine the disruptive critical voltage and visual corona voltage of local and general corona for a 3 phase 200 kV line consisting of 20.32 mm diameter conductors spaced in a 6.4m delta configuration. It is assumed as the temperature of 20^0C, pressure of 71cm of mercury, surface factor of 0.92, and irregularity factor for local corona 0.71, irregularity factor for general corona 0.81? [7M]

UNIT-V

9. a) Derive the expression and explain various factors of sag dependency? [7M]
   b) Compare the properties of strain type and shackle type insulators with diagrams? [7M]

(OR)

10. a) Derive and analyze the expressions of longest and lowest supports with relevant to the sag calculations? [7M]
    b) An over head line is supported across a span of 192 m on level supports. The conductor has a diameter of 1.32cm and a dead weight of 1.07 kg/m. The line is subjected to wind pressure of 3.66 kg/m^2 of projected area. The radial thickness of ice is 1.33 cm. Find the sag in the inclined direction and in vertical direction? Assume maximum working stress of 1030 kg/cm^2 and ice weighs 912.7 kg/m^3? [7M]

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