INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

Department of Electrical and Electronics Engineering

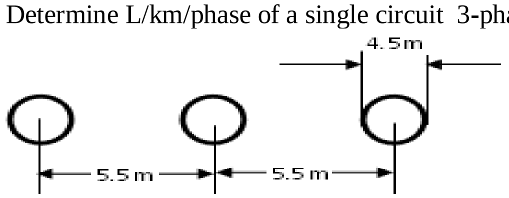
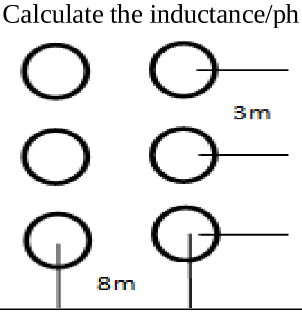
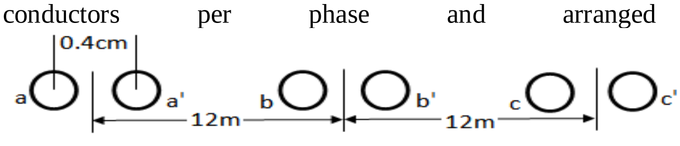
QUESTION BANK

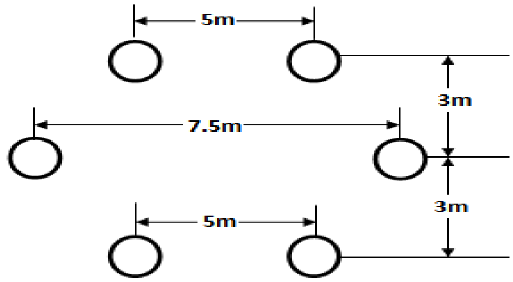
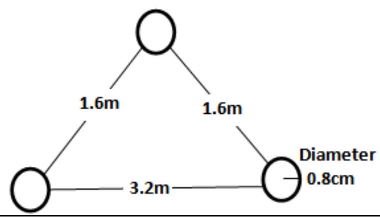
Course Name	:	**POWER SYSTEMS - II**
Course Code	:	**A50221**
Class	:	**III B. Tech I Semester**
Branch	:	**Electrical and Electronics Engineering**
Year	:	**2017 - 2018**
Course Faculty	:	K.Raju, Assistant Professor

OBJECTIVES

This course is an extension of Power systems-I. It deals with basic theory of transmission lines modelling and their performance analysis. Also this course gives emphasis on mechanical design of transmission lines, cables and insulators

S. No	Question	Blooms Taxonomy Level	Course Outcome
UNIT - 1 TRANSMISSION LINE PARAMETERS			
Part - A (Short Answer Questions)			
1	What is a transmission line?	Remember	1
2	Define a two –wire transmission system?	Understand	1
3	What do you mean by internal and external flux linkage?	Remember	1
4	Define permeability of a conductor?	Understand	1
5	What is a composite conductor?	Remember	1
6	Define inductive reactance spacing factor?	Remember	1
7	What is the difference between single and double circuit?	Understand	1
8	Give the expansion of GMR and GMD.	Understand	1
9	What is transposed line?	Remember	1
10	What is skin effect?	Remember	1
11	Differentiate the stranded conductor and bundled conductor?	Understand	1
12	List out the advantages of double circuit lines.	Understand	1
13	What is transposition of conductors?	Understand	1
14	What is fictitious conductor radius?	Understand	1
15	Define unsymmetrical and symmetrical spacing?	Understand	1
Part - B (Long Answer Questions)			
1	Derive an expression for inductance of a conductor due to external flux.	Applying	1
2	With a diagram explain equilateral and unsymmetrical spacing of conductors.	Understand	1
3	A Single phase line of 230V has conductor spacing of 135cm.The radius of conductor is 0.8cm.Calculate the loop inductance in mH of the line per km.	Analyzing	1
4	Compare the capacitance of a three phase double circuit line with symmetrical spacing with the Capacitance of a three phase double circuit line with unsymmetrical spacing.	Analyzing	1
5	Discuss effect of earth on the capacitance of the line.	Analyzing	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
6	A wire 4mm in diameter is suspended at constant height 10meters above sea level which constitutes the return conductor. Calculate the inductance of the system per km.	Analyzing	1
7	A 3-phase overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 2mside.Calculate the capacitance of each line conductor per km. Given that diameter of each conductor is 1.25cm	Analyzing	1
8	Explain the concept of self and mutual GMDs.	Analyzing	1
9	Calculate the inductance of each conductor of 3-phase.3 wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31}=4mt,D_{12}=D_{23}=2mt.The conductors are transposed and have a diameter of 3cm.	Analyzing	1
10	Explain the concept of transposed and untransposed line with unsymmetrical spacing?	Understand	1
11	Derive an expression for capacitances of a single phase transmission system and discuss the effect of earth on capacitance with suitable equation.	Analyzing	1
12	Derive an expression for inductance Of a single-phase overhead line.	Analyzing	1
13	Derive the expression for inductance of a two wire 1Φ transmission line.	Analyzing	1
14	What are the advantages of bundled conductors?	Analyzing	1
15	Derive the expression for the capacitance per phase of the 3 Φ double circuit line flat vertical spacing with transposition.	Analyzing	1
	Part – C (Analytical Questions)		
1	A 3-phase , 50hz, 66kv over head transmission line has conductors arranged at the corners of an equivalent triangular of 3m sides and the diameter of each conductor is 1.5cm determine ‘L‘ and ‘C’ per phase, if l=100km. also calculate charging current.	Analyzing	1
2	Calculate L of a single phase two wire system if D=2m and r=1.2cm?	Analyzing	1
3	Two conductor of a single phase line each diameter 2cm, arranged in a vertical plane with are conductor mounted 2m above the other. A second identical line is mounted at the same height as the first and space horizontally 0.5m apart from it and connected in parallel. Determine L/km.	Analyzing	1
4	Determine L/km/phase of a single circuit 3-phase,20kv line given 	Analyzing	1
5	A 3-phase transmission line100km long diameter =0.5cm spaced at the corner of an equivalent triangular of 120cm sides find inductance km/ph. Derive the formula used.	Analyzing	1
6	Calculate the inductance/ph if diameter=1.5cm 	Analyzing	1
7	Determine the inductance per km of a three phase transmission line having conductors per phase and arranged as shown. 	Analyzing	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
8	Determine the inductance per Km of a double circuit 3-phase line is transposed with in each circuit and each circuit remains at its outside. The diameters of each  conductor in 15mm.	Analyzing	1
9	Determine the capacitance and the charging inductance per Km. when the transmission line of figure operating at 132kv. 	Analyzing	1
10	Derive an expression for the capacitance per km of a single phase line taking into account the effect of ground	Analyzing	1
11	Find the capacitance between the conductors of a single-phase 10 km long line. The diameter of each conductor is 1.213cm. The spacing between conductors is 1.25m. Also find the capacitance of each conductor neutral.	Analyzing	1
12	Derive the expression for capacitance of a double circuit line for hexagonal spacing.	Analyzing	1
13	A 3 Φ overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 2m side. Calculate the capacitance of each line conductor per km. Given the diameter of each conductor is 1.25cm.	Analyzing	1
14	Find the capacitance per km per phase of a 3Φ line arrangement in a horizontal plane spaced 8 metres apart. The height of all conductors above the earth is 13 metres. The diameter of each conductor is 2.6 cm. the line is completely transposed and takes the effect of ground into account.	Analyzing	1
15	A 3-phase overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 2mside.Calculate the capacitance of each line conductor per km.Given that diameter of each conductor is 1.25cm	Analyzing	1
UNIT – II PERFORMANCE OF SHORT,MEDIUM AND LONG LENGTH TRANSMISSION LINES			
Part - A (Short Answer Questions)			
1	Give classification of overhead transmission line.	Understand	2
2	Draw equivalent T and π network.	Creating	2
3	What is surge impedance loading?	Understand	2
4	What are ABCD constants in a transmission line?	Remember	2
5	What is reflected and refracted wave?	Remember	2
6	What are the limitations of T and π methods?	Understand	2
7	Define characteristic impedance of a transmission line.	Remember	2
8	What is the purpose of using series reactors on a transmission line?	Applying	2
9	Why do we analyze a three phase transmission line on single phase basis?	Applying	2
10	What is the length of short, long and medium transmission line?	Applying	2
11	Define transmission efficiency.	Remember	2
12	List out the common methods of representation of medium transmission lines.	Remember	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
13	Define voltage regulation.	Remember	2
14	What are the voltages regulating equipments used in transmission systems?	Remember	2
15	Classify overhead transmission lines.	Remember	2
	Part - B (Long Answer Questions)		
1	What do you mean by medium transmission line? How capacitance effect is taken to account.	Understand	2
2	Show how regulation and efficiency are determined in nominal T and nominal π method.		2
3	A I-phase transmission line has a resistance of 0.2Ω and an inductance of 0.4Ω.Find the voltage at the sending end to give 500KVA at 2KV at the receiving end at load power factor of i)unity ii).707 lagging	Analyzing	2
4	using rigorous method, derive expression for sending end voltage for a long transmission line.	Analyzing	2
5	Determine A,B,C,D constants for a 3-phase 50Hz transmission line 200km long having the following parameters l=1.2*10-3H/km c=8*10-9F/km r=0.15Ω/km. Use nominal T-Method	Analyzing	2
6	Determine A,B,C,D constants for a 3-phase 50Hz transmission line 200km long having the following parameters l=1.2*10-3H/km c=8*10-9F/km r=0.15Ω/km . Use nominal PIE method	Analyzing	2
7	Explain how voltages and currents are evaluated in long transmission lines.	Understand	2
8	Derive expression for surge impedance.	Applying	2
9	Determine A,B,C,D constants for a 3-phase 50Hz transmission line 200km long having the following distributed parameters l=1.2*10-3H/km c=8*10-9F/km r=0.15Ω/km g=0	Analyzing	2
10	compare A,B,C,D parameters of short ,Nominal T ,Pie and long lines	Applying	2
11	Enumerate the important methods in use for improving the power factor at the receiving end of a transmission line	Applying	2
12	Discuss the action of a synchronous phase modifiers for voltage regulation of a line and explain carefully how its use increases the current carrying capacity of a transmission line.	Applying	2
13	Show that the following relationships hold for a transmission line Vs=DVr + BIr Is = CVr + DIr Where Vs,Is and Vr ,Ir denotes sending end and receiving voltages and currents respectively and A,B,C,D are auxiliary constants	Applying	2
14	Expain the feranti effect in long transmission lines	Applying	2
15	Derive the expression for ABCD parameters of medium transmission lines by π-method draw the vector diagram.	Applying	2
	Part – C (Analytical Questions)		
1	A 1-phase transmission line has a resistance of 0.20 ohm and an inductance of 0.40 ohm. Find the voltage at the sending end to give 500KVA at 2KV at the receiving end at power factor of (i) Unity (ii) 0.707 lagging. Illustrate with suitable phaser diagrams.	Analyzing	2
2	A 60 Hz short line has resistance of 0.62 ohm/ph and inductance of 93.24 mh/ph. The line supplies a load(Y connected) of 100µW at 0.9 p.f.(lag) and at 215KV(L-L). Calculate sending-end voltage per phase	Analyzing	2
3	Define A, B, C & D constants of a transmission line? What are their values in short lines?	Analyzing	2
4	A 3-Ph, 3km long line delivers 300 kW at a PF of 0.8 lag to a load if the voltage at the supply end is 11kV, determine the voltage at the load end, % regulation, sending end PF and the efficiency of Tr. line. The resistance and reactance of each conductor per km are 0.4 Ohm and 0.3 Ohm respectively	Analyzing	2
5	Find the values of A, B, C & D in the nominal - method in terms of Z & Y.	Analyzing	2

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6	A 3-Ph overhead line has a resistance of 2Ohm/Ph and reactance of 6Ohm/Ph. It supplies a load of 10 MVA at a PF of 0.8 leading at 33kV between lines at far end. Find i. Sending End Voltage **ii.** % Regulation **iii.** Sending End PF **iv.** Transmission Efficiency	Analyzing	2
7	Derive equation which represents the performance of a long transmission line with its electrical parameters uniformly distributed along its length?	Analyzing	2
8	Calculate the distance over which a load of 15MW at 0.85 p.f. can be delivered by a 3 phase transmission line having conductor seah of resistance 0.905 ohm/km. The receiving end voltage is 132kv and the loss is to be 7.5% of the load.	Analyzing	2
9	Determine the sending end voltage current, power and power factor for a 160km section of 3-phase line delivering 50MVA at 132kv and p.f. 0.8 lagging. Also find the efficiency and regulation of the line. Resistance per line 0.1557 ohm per km, spacing 3.7 m, 6.475 m, 7.4 m transposed. Evaluate the A,B,C,D parameters also. Diameter is 1.956cm.	Analyzing	2
10	Show that for a transmission line receiving end voltage and current(Vr and Ir) in terms of sending end voltage and current(Vs and Is) and auxiliary constants are given by Vr= DVs – Bis and Ir= -CVs + AIs.	Analyzing	2
11	Determine the efficiency and regulation of a 3phase, 100Km, 50 Hz transmission line delivering 20 MW at a power factor of 0.8 lagging and 66 kV to a balanced load. The conductors are of copper, each having resistance 0.1 Ω / Km, 1.5 cm outside dia, spaced equilaterally 2 metres between centres. Use nominal T method.	Analyzing	2
12	A three phase 5 km long transmission line, having resistance of 0.5 Ω / km and inductance of 1.76mH/km is delivering power at 0.8 pf lagging. The receiving end voltage is 32kV. If the supply end voltage is 33 kV, 50 Hz, find line current, regulation and efficiency of the transmission line.	Analyzing	2
13	A 220kV, 3Φ transmission line has an impedance per phase of (40+j200)Ω and an admittance of (0+j0.0015) mho. Determine the sending end voltage and sending end current when the receiving end current is 200 A at 0.95 pf lagging. Use nominal method	Analyzing	2
14	Determine the efficiency and regulation of a three phase 200 km, 50Hz Transmission line delivering 100MW at a pf of 0.8 lagging and 33kV to a balanced load. The conductors are of copper, each having resistance 0.1 Ω/km, and 1.5cm outside dia, spaced equilaterally 2m between centres. Neglect leakage reactance and use nominal T and π methods	Analyzing	2
15	A 50Hz transmission line 300 km long total series impedance of 40+j25 Ω and total shunt admittance of 10-3 mho. The 220 Kv with 0.8 lagging power factor. Find the sending end voltage, current, power and power factor using nominal pi method.	Analyzing	2
UNIT – III POWER SYSTEM TRANSIENTS AND FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSION LINES			
Part - A (Short Answer Questions)			
1	What are the types of power system transients?	Remember	3
2	Name the various types of Transients in power system.	Remember	3
3	What are the specifications of a traveling wave?	Remember	3
4	Write the expression for series and shunt lumped parameters in distributed lines.	Applying	3
5	What is meant by reflection and refraction of traveling waves.	Understand	3
6	What is Ferranti effect?	Understand	3
7	Define voltage regulation and efficiency of a transmission line.	Understand	3
8	What are disruptive and visual critical voltages?	Understand	3
9	Define corona?	Understand	3
10	What are the factors affecting corona?	Remember	3
11	What is tuned power line?	Remember	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
12	What is surge impedance loading or natural loading?	Remember	3
13	Why Bewley lattice diagram is used.	Remember	3
14	What are the reflection and refraction coefficients of a short circuited line	Remember	3
15	What are the reflection and refraction coefficients of an open circuited line	Remember	3
Part - B (Long Answer Questions)			
1	Discuss transient response of systems with series and shunt lumped parameters and distributed lines.	Understand	3
2	With neat sketch explain Bewley's Lattice diagram?	Remember	3
3	Derive the reflection and refraction coefficients of a traveling wave.	Applying	3
4	Explain skin and proximity effects on transmission line?	Understand	3
5	Explain the effect of regulation on the transmission line?	Understand	3
6	Derive an expression for disruptive and visual critical voltages.	Applying	3
7	Discuss power loss due to corona	Understand	3
8	Explain clearly the "Ferranti effect" with a phasor diagram?	Understand	3
9	Describe the phenomenon of corona? How can the corona loss are minimized in transmission lines.	Understand	3
10	Derive the expression for wave equation of a travelling wave	Applying	3
11	Define the characteristic impedance of a transmission line show that it is given by Z_C= where ZOC and ZSC are the impedance measured at the sending end with receiving end open-circuited and short-circuited respectively	Applying	3
12	A step wave of 100kV travels through a line having a surge impedance of 400 ohms. The line is terminated by and inductance of 4000 μH. find the voltage across the inductance and the reflected voltage wave	Applying	3
13	Derive the reflection and refraction coefficients of a traveling wave of open circuited line	Applying	3
14	Derive the reflection and refraction coefficients of a traveling waves short circuited line.	Applying	3
15	Derive the reflection and refraction coefficients of a traveling wave line terminated with inductance.	Applying	3
Part – C (Analytical Questions)			
1	An overhead transmission line with surge impedance 400Ω is 300 km long. One end of this line is short circuited and at the other end a source of 11KV is suddenly switched on. Calculate the current at source end 0.005 sec after the voltage is applied.	Analyzing	3
2	A Step wave of 110 KV travels through a line having a surge impedance of 5000μH. Find the voltage across the inductance and reflection wave.	Analyzing	3
3	The two long transmission lines A and C are connected by a cable of 1 Km long. The surge impedance of A,B,C are 400, 50 and 500 Ohms respectively. A rectangular value wave of 25 KV magnitude and of infinite length is initiated in A and travels to C. Determine the first and second voltage	Analyzing	3
4	A surge of 110KV travels a line of surge impedance of 500 ohms and reaches a T junction. The surge impedance of the branch line are 450 and 50 ohms. Determine the reflection and refracted value of VOLTAGE	Analyzing	3
5	A 3-phase, 220 kV, 50 Hz transmission line consists of 1·5 cm radius conductor spaced 2 metres apart in equilateral triangular formation. If the temperature is 40ºC and atmospheric pressure is 76 cm, calculate the corona loss per km of the line. Take mo = 0·85.	Analyzing	3
6	A 132 kV line with 1·956 cm dia. conductors is built so that corona takes place if the line voltage exceeds 210 kV (r.m.s.). If the value of potential gradient at which ionisation occurs can be taken as 30 kV per cm, find the spacing between the conductors.	Analyzing	3
7	A certain 3-phase equilateral transmission line has a total corona loss of 53 kW at 106 kV and a loss of 98 kW at 110·9 kV. What is the disruptive critical voltage?	Analyzing	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	What is the corona loss at 113 kV?		
8	Estimate the corona loss for a three-phase, 110 kV, 50 Hz, 150 km long transmission line consisting of three conductors each of 10 mm diameter and spaced 2·5 m apart in an equilateral triangle formation. The temperature of air is 30ºC and the atmospheric pressure is 750 mm of mercury. Take irregularity factor as 0·85. Ionisation of air may be assumed to take place at a maximum voltage gradient of 30 kV/ cm.	Analyzing	3
9	Taking the dielectric strength of air to be 30 kV/cm, calculate the disruptive critical voltage for a 3-phase line with conductors of 1 cm radius and spaced symmetrically 4 m apart	Analyzing	3
10	A 3-phase, 220 kV, 50 Hz transmission line consists of 1·2 cm radius conductors spaced 2 m at the corners of an equilateral triangle. Calculate the corona loss per km of the line. The condition of the wire is smoothly weathered and the weather is fair with temperature of 20ºC and barometric pressure of 72·2 cm of Hg.	Analyzing	3
11	Find the corona characteristics of a 11 kv, 50 Hz, 3-phase transmission line 175 km long consisting of three 1 cm dia stranded copper conductors spaced in 3 meters delta arrangement. Temperature 26^0C and barometric pressure is 74 cm, m=0.85. m_v for local corona=0.72 and m_v for general corona=0.82	Analyzing	3
12	A single phase overhead line has two conductors of diameter 1 cm with a spacing of 1 meter between centers. If the disruptive critical voltage for air is 21 kV/cm, for what value of the line voltage will corona commence?	Analyzing	3
13	A certain 3 – phase equilateral transmission line has a total corona loss of 33 kW at 106 kV and a loss of 98 kW at 110.9 kV. What is the disruptive critical voltage? what is the corona loss at 113 kV	Analyzing	3
14	An overhead transmission line 186 miles having a surge impedance of 500 ohms is short circuited at one end and steady state voltage of 3000 volts is applied suddenly at the other end. Neglecting the resistance, explain with diagrams, how the current and voltage change at different parts of the line and calculate the current at the sending end of the line 0.004 seconds after the voltage is applied	Analyzing	3
15	A cable with a surge impedance of 100 ohms is terminated in two parallel connected open wires having surge impedance of 600 ohms and 1000 respectively. If the steep fronted voltage of 3 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. The average wave be assumed to be infinite length	Analyzing	3
UNIT – IV (OVERHEAD LINE INSULATORS AND SAG TENSION CALCULATIONS)			
Part - A (Short Answer Questions)			
1	What is sag?	Understand	6
2	What is the significance of stringing chart?	Remember	6
3	A single phase overhead line consists of two conductors of dia 2cm with a spacing of 1.5m between centres. Determine line voltage for commencing of corona. Dielective strength of air =21kv/cm.	Analyzing	6
4	What are the disadvantages of corona?	Understand	6
5	What is the significance of shunt compensation?	Remember	6
6	What are the various types of insulators?	Remember	6
7	Define string efficiency	Understand	6
8	What are the various methods to improve string efficiency?	Remember	6
9	What are the various tests conducted on insulators?	Remember	6
10	What is insulation failure?	Understand	6
11	What is the reason for sag in transmission line?	Understand	6
12	Mention the factors that affect sag in the transmission line.	Understand	6
13	Define impulse ratio.	Understand	6
14	Write short notes on puncture test.	Understand	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
15	What is the purpose of insulator?	Understand	6
	Part - B (Long Answer Questions)		
1	Show how the sag of an overhead line can be calculated in case of supports at different levels.	Applying	6
2	Show how the sag of an overhead line can be calculated in case of supports at same level	Applying	6
3	An overhead transmission line has a span of 220meters,theconductor weighing 604kg/km.Calculate the maximum sag if the ultimate tensile strength of conductor is 5758kg.Assume a factor of safety=2.	Analyzing	6
4	Show how the effect of wind and ice loading are taken into account while determining the sgans stress of an overhead line conductor.	Applying	6
5	Write a note on stringing charts and sag template.	Remember	6
6	Write short notes on different types of insulators used for overhead lines and their application.	Remember	6
7	A string of 6 insulator units has a self-capacitance equal to 10 times the pin to earth capacitance. Find voltage distribution across various units as a percentage of total voltage across the string.	Analyzing	6
8	Explain various methods for equalizing the potential across the various units in an insulator string.	Understand	6
9	Discuss various methods for improving the string efficiency in a string of insulators.	Understand	6
10	Show that in a string of suspension insulators, the disc nearest to the conductor has the highest voltage across it.	Applying	6
11	Derive expressions for sag and tension in a power conductor strung between to supports at equal heights taking into account the wind and ice loading also.	Analyzing	6
12	Derive the expressions for sag and conductor length under bad weather Conditions. Assume Shape of overhead line is a parabola.	Analyzing	6
13	Show how the sag of an overhead line can be calculated in case of supports at different level	Analyzing	6
14	Explain the necessity of stinging chart for a transmission line and show how how chart can be constructed	Analyzing	6
15	Give the reasons : (i) It is necessary to use high voltage for transmission systems (ii) At 400 kV and above the transmission lines have bundled conductors (iii) Corona loss is more in stormy weather than during fair weather	Understand	6
	Part – C (Analytical Questions)		
1	In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find (i) the distribution of voltage over 3 insulators and (ii) string efficiency.	Analyzing	6
2	Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17·5 kV, calculate the line to neutral voltage. Assume that the shunt capacitance betwen each insulator and earth is 1/8th of the capacitance of the insulator itself. Also find the string efficiency.	Analyzing	6
3	The three bus-bar conductors in an outdoor substation are supported by units of post type insulators. Each unit consists of a stack of 3 pin type insulators fixed one on the top of the other. The voltage across the lowest insulator is 13·1 kV and that across the next unit is 11 kV. Find the bus-bar voltage of the station.	Analyzing	6
4	A string of 5 insulators is connected across a 100 kV line. If the capacitance of each disc to earth is 0·1 of the capacitance of the insulator, calculate (i) the distribution of voltage on the insulator discs and (ii) the string efficiency.	Analyzing	6
5	Each line of a 3-phase system is suspended by a string of 3 indentical insulators of self-capacitance C farad. The shunt capacitance of connecting metal work of each insulator is 0·2 C to earth and 0·1 C to line. Calculate the string efficiency of the system if a guard ring increases the capacitance to the line of metal work of the lowest insulator to 0·3 C.	Analyzing	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
6	A 132 kV transmission line has the following data : Wt. of conductor = 680 kg/km ; Length of span = 260 m Ultimate strength = 3100 kg ; Safety factor = 2 Calculate the height above ground at which the conductor should be supported. Ground clearance required is 10 metres.	Analyzing	6
7	A transmission line has a span of 200 metres between level supports. The conductor has a cross-sectional area of 1·29 cm2, weighs 1170 kg/km and has a breaking stress of 4218 kg/cm2. Calculate the sag for a safety factor of 5, allowing a wind pressure of 122 kg per square metre of projected area. What is the vertical sag?	Analyzing	6
8	A transmission line has a span of 275 m between level supports. The conductor has an effective diameter of 1·96 cm and weighs 0·865 kg/m. Its ultimate strength is 8060 kg. If the conductor has ice coating of radial thickness 1·27 cm and is subjected to a wind pressure of 3·9 gm/ cm2 of projected area, calculate sag for a safety factor of 2. Weight of 1 c.c. of ice is 0·91 gm.	Analyzing	6
9	A transmission line has a span of 275 m between level supports. The conductor has an effective diameter of 1·96 cm and weighs 0·865 kg/m. Its ultimate strength is 8060 kg. If the conductor has ice coating of radial thickness 1·27 cm and is subjected to a wind pressure of 3·9 gm/ cm2 of projected area, calculate sag for a safety factor of 2. Weight of 1 c.c. of ice is 0·91 gm.	Analyzing	6
10	An overhead line has a span of 150 m between level supports. The conductor has a cross-sectional area of 2 cm2. The ultimate strength is 5000 kg/cm2 and safety factor is 5. The specific gravity of the material is 8·9 gm/cc. The wind pressure is 1·5 kg/m. Calculate the height of the conductor above the ground level at which it should be supported if a minimum clearance of 7 m is to be left between the ground and the conductor.	Analyzing	6
11	A 132-Kv transmission line uses A.C.S.R conductors whose data are: Nominal copper area 110 mm^2 , size 30+7/2.79 mm, weight 844 kg/Km: ultimate strength 7950 Kg. Calculate the height above ground at which the conductors with a span of 300 meters should be supported the factor of safety being 2. Wind pressure 75 Kg/m^2 of projected area. Ground clearance required is 7 meters	Analyzing	6
12	Calculate maximum sag(total and vertical) of a line with the copper conductor 7/0.295 cm size, area 0.484 sq.cm . overall dia.0.889 cm, weight 428 kg/km and breaking strength 1093 kg. Assume factor of safety 2,. Span 200 meters, level supports- (i) Due to weight of the conductor (ii) Due to additional weight of ice loading of 1 cm thickness (iii) Due to both (i) and (ii) plus wind acting horizontally at a pressure of 39 Kg per sq metre	Analyzing	6
13	A string of 6 suspension type insulators is to be graded to obtain uniform distribution of voltage across the string. If the pin- to earth capacitances are all equal to C and the mutual capacitance of the top insulator is 10 C find the mutual capacitance of each unit in terms of C.	Analyzing	6
14	In a 5 insulator disc string capacitance between each unit and earth is 1/6 of the mutual capacitance. Find the voltage distribution across each insulators in the string as %age of the voltage of the conductor to earth. Find the string efficiency. How is this efficiency affected by rain	Analyzing	6
15	An overhead transmission line at a river crossing is supported from two towers at heights of 25 meters and 75 meters above water level. He horizontal distance between the towers is 250 meters. If the requires clearance between the conductors and the water midway between the towers is 45 meters and if both the towers are on the same side of the point of maximum sag of the parabola configuration find, the stringing tension in the conductor. The weight of the conductor is 0.70 kg/metre Also find the span allowable for the same sag if the supports were level.	Analyzing	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
UNIT – V UNDERGROUND CABLES			
Part - A (Short Answer Questions)			
1	What are the practical difficulties in grading?	Applying	7
2	What is the purpose of guard ring?	Applying	7
3	What is the purpose of using inters heath in a cable?	Applying	7
4	A 3- core cable gives on test a capacitance measurement of 2µF between two cores find the line charging current of the cable when it is connected to 11kv,50Hz supply system.	Analyzing	7
5	A single-core cable has a conductor diameter of 1cm and insulation thickness of 0·4 cm. If the specific resistance of insulation is 5 × 1014 Ω-cm, calculate the insulation resistance for a 2 km length of the cable.	Analyzing	7
6	What is meant by serving of a cable?	Applying	7
7	In what way AI sheaths are superior to lead sheaths?	Applying	7
8	Mention the advantages of PVC over paper insulated cables.	Applying	7
9	Where CSA sheath is used in cables? Why is it used?	Applying	7
10	Compare the merits and demerits of underground system versus overhead system.	Remember	7
11	What is the main purpose of Armouring?	Remember	7
12	What is the function of sheath in a cables.	Remember	7
13	State the properties of insulating materials.	Remember	7
14	Mention the commonly used power cables.	Remember	7
15	Why protective covering is done in cables?	Remember	7
Part - B (Long Answer Questions)			
1	Derive an expression for stress at the sheath in insulator.	Applying	7
2	Derive an expression for capacitance grading in cable.	Applying	7
3	Comment on power factor in cables.	Understand	7
4	Discuss various problems in laying cable.	Understand	7
5	State the classification of cables and discuss their general construction.	Understand	7
6	Write a short note on pressure cables.	Understand	7
7	Explain why the potential distribution is not in general uniform over the string of suspension type insulators?	Remember	7
8	State the classification of cables (according to voltage) and discuss their general construction.	Understand	7
9	Calculate the capacitance of the cable of 100KM long with internal and external radi 0.5 & 1.0cm. Given relative permittivity of the material is 3.	Analyzing	7
10	What is meant by capacitance grading of a cable? Derive expression for capacitance and maximum potential gradients in two (or more) dielectrics of a graded cable in terms of dielectric constants and radius of core and overall radius etc.	Analyzing	7
11	Derive the expression for insulator resistance, capacitance and electric stress in a single core cable. Where is the stress maximum and minimum?	Analyzing	7
12	Describe with the neat sketch, the construction of a 3 core belted type cable.	Analyzing	7
13	Briefly explain about various types of cables used in underground system?	Remember	7
14	Explain the constructional features of one LT and HT cable?	Remember	7
15	Compare and contrast overhead lines and underground cables.	Remember	7
Part – C (Analytical Questions)			
1	A transmission conductor is suspended by a string of 3 similar units; the self capacitance of each unit is C farad and the mutual capacitance is 0.1C farad. Determine the voltage distribution across the string if the maximum voltage per unit	Analyzing	7

S. No	Question	Blooms Taxonomy Level	Course Outcome
	is 20KV hence determine the string efficiency?		
2	Write a short note on different types of insulators used for overhead lines and their applications.	Understand	7
3	Find the voltage across each unit of an overhead line suspension insulator string consisting of similar units if the voltage between the line conductor and earth is 60 kv and the ratio of the capacitance of each insulator unit to the capacitance relative to earth of each intermediate section of the connecting network is 10:1. Assume no leakage takes place. Also calculate the string efficiency.	Analyzing	7
4	A string of 5 suspension insulators is to be graded for obtaining uniform voltage distribution across the string. If the pin to earth capacitances are all equal to “C” and the mutual capacitance of the top insulator is 10C, find the mutual capacitance of each unit in terms of C.	Analyzing	7
5	Calculate the insulation resistance for 5km length of a 1-core cable. Resistance of insulation(impregnated paper) is 5×10^14 ohm-cm, insulation thickness is 1 cm and radius of conductor is 1.25 cm.	Analyzing	7
6	The capacitances of a 3-phase belted cable are 12·6 μF between the three cores bunched together and the lead sheath and 7·4 μF between one core and the other two connected to sheath. Find the charging current drawn by the cable when connected to 66 kV, 50 Hz supply.	Analyzing	7
7	The insulation resistance of a single-core cable is 495 MΩ per km. If the core diameter is 2·5 cm and resistivity of insulation is 4·5 × 1014 Ω-cm, find the insulation thickness.	Analyzing	7
8	A 33 kV, 50 Hz, 3-phase underground cable, 4 km long uses three single core cables. Each of the conductor has a diameter of 2·5 cm and the radial thickness of insulation is 0·5 cm. Determine (i) capacitance of the cable/phase (ii) charging current/phase (iii) total charging kVAR. The relative permittivity of insulation is 3.	Analyzing	7
9	Calculate the capacitance and charging current of a single core cable used on a 3-phase, 66 kV system. The cable is 1 km long having a core diameter of 10 cm and an impregnated paper insulation of thickness 7 cm. The relative permittivity of the insulation may be taken as 4 and the supply at 50 Hz.	Analyzing	7
10	A single core lead sheathed cable has a conductor diameter of 3 cm; the diameter of the cable being 9 cm. The cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively with corresponding safe working stresses of 30 kV/cm and 20 kV/cm. Calculate the radial thickness of each insulation and the safe working voltage of the cable.	Analyzing	7
11	A single core cable has a conductor diameter of 1 cm and internal sheath diameter of 1·8 cm. If impregnated paper of relative permittivity 4 is used as the insulation, calculate the capacitance for 1 7km length of the cable.	Analyzing	7
12	A7 33 kV single core cable has a conductor diameter of 1 cm and a sheath of inside diameter 4 cm. Find the maximum and minimum stress in the insulation.	Analyzing	7
13	Find the most economical value of diameter of a single-core cable to be used on 50 kV, single-phase system. The maximum permissible stress in the dielectric is not to exceed 40 kV/cm.	Analyzing	7
14	The capacitance per kilometer of a 3-phase belted cable is 0·3 μ F between the two cores with the third core connected to the lead sheath. Calculate the charging current taken by five kilometers of this cable when connected to a 3-phase, 50 Hz, 11 kV supply.	Analyzing	7
15	A single core cable has a conductor diameter of 2.5 cm and a sheath of inside diameter of 6 cm. calculates the maximum stress. It is desired to reduce the maximum stress by using two intersheaths. Determine their best position, the maximum stress and the voltage on each; system voltage is 3 phase 66kv.	Analyzing	7

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