JUNE 2024

409/2(N)

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

Time Allowed: 3 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer. However, no marks will be given for wrong explanation of the answer of each MCQ type question.
Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): 2×10=20

i. Which of the following is neglected while analyzing a short transmission line?
(a) Series impedance
(b) Shunt admittance
(c) Power loss
(d) None of these

ii. A 70/6 ACSR conductor is an aluminium conductor steel reinforced, having
(a) cross- sectional area of aluminium as 70 mm^2 and the cross-sectional area of steel as 6 mm^2.
(b) cross-sectional area of steel as 70 mm^2 and the cross-sectional area of aluminium as 6 mm^2.
(c) 70 aluminium conductors and 6 steel conductors.
(d) 80 steel conductors and 6 aluminium conductors.

iii. Guy wire is used to
(a) support the pole.
(b) provide protection against surges.
(c) provide emergency earth route.
(d) protect conductors against short-circuiting.

iv. Suspension type insulators are used for voltages beyond —
(a) 33 kV
(b) 400 kV
(c) 11 kV
(d) 66 kV.

v. Transposition of transmission line is done to
(a) reduce corona
(b) reduce skin effect
(c) reduce proximity effect
(d) balance line voltage drop

vi. Find the surge impedance of a line when inductance is 160 mH and capacitance is 1μF.
(a) 100 Ω
(b) 200 Ω
(c) 160 Ω
(d) 400 Ω

vii. In DC transmission, full cross-section of the conductor is utilized because of no
(a) inductance
(b) capacitance
(c) phase displacement
(d) skin effect

viii. Which of the following relationships is not valid for short transmission lines?
(a) Is = Ir
(b) B =Z =C
(c) A = D = 1
(d) none of these

ix. The point of minimum potential for a uniform distributor, fed at one end is at
(a) the middle.
(b) the far end.
(c) a point between the far end and the middle.
(d) a point between the feeding end and the middle.

x. A long transmission line is energized at the sending end and is kept open-circuited at the receivingend. The magnitudes of the sending-end voltage V_s and of the receiving-end voltage Vr satisfy the following relationship
(a) Vs = Vr
(b) Vs is greater than Vr
(c) Vs is less than Vr
(d) none

xi. For combined 3Ø power and lighting load . . . . . system is used
(a) 1 Phase 2 Wire
(b) 2 Phase 2 Wire
(c) 3 phase 3 Wire
(d) 3 Phase 4 Wire

xii. Which of the following power distribution system gives the better reliability?
(a) Ring-main system
(b) Radial system
(c) DC three-wire system
(d)all of the above

xiii. For the transmission of high voltage better system is
(a) HVDC
(b) EHV AC
(c) both
(d) none of the above.

xiv. Outdoor sub-station should be located ---
(a) load center
(b) away from load center
(c) rural area
(d) none of the above.

xv. A 100 kV transmission line has an ultimate strength of 3000 kg, a safety factor of 3 and a workingtension of _____kg.
(a) 1000
(b) 2000
(c) 3000
(d) 9000

GROUP-B
Answer any Five (05) questions.

2. (a) A 2-conductor cable 1 km long is required to supply a constant current of 200 A throughout the year. The cost of cable, including installation, is Rs. (20 a + 20) per meter where 'a' is the area of X-section of the conductor in cm^2. The cost of energy is 5 Paisa/kWh and interest and depreciation charges amount to 10%. Calculate the most economical conductor size. [resistivity of conductor material is 1·73 micro-ohm-cm.]
(b) Write down the advantages of HVDC transmission system over AC transmission system. 5+3

3. (a) Derive the expression of rise in voltage at the receiving end for a medium transmission line with no load or light load.
(b) State the physical significance of surge impedance loading (SIL).
(c) Where do we use strain type insulators? 5+2+1

4. (a) Define critical disruptive voltage of corona discharge.
(b) Mention the methods of reducing corona in transmission line.
(c) Explain the methods of cable laying. 3+2+3

5. (a) Draw the layout of monopolar and bi-polar dc link. Explain which one is more reliable DC transmission system among these two.
(b) Compare between underground and overhead ac distribution systems. (3+2) +3

6. (a) A transmission line has a span of 150 m between supports. The conductor has a cross sectional area of 2 cm^2, the tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9.85 gm/cm^3 and wind force is 1.5 kg/m length. Calculate the sag.
(b) Define stringing charts. 6+2

7. (a) An overhead 3 phase transmission line delivers 5000 kW at 22 kV at 0.8 p.f. lagging. The resistance and reactance of each conductor is 4 Ω and 6 Ω respectively. Determine (i) sending end voltage (ii) percentage voltage regulation and (iii) transmission efficiency.
(b) How skin effect can be reduced? (2+2+2) +2

8. (a) Draw the layout of radial and interconnected AC distribution systems. Which one is more reliable among these two systems? Justify with suitable reasons.
(b) Draw the single line diagram (SLD) of a typical 11kV/415V substation. (4+1) +3

9. (a) Each conductor of a 33 kV, three-phase system is suspended by a string of three similar insulators; the capacitance of each disc is 10 times the capacitance to earth. Calculate the voltage across each insulator and also determine the string efficiency.
(b) State the most appropriate method to increase the string efficiency of suspension type insulator with justification. (3+2) +3

10. (a) A 3-Phase, 50Hz, 415V motor develops 100 H.P, the power factor being 0.75 lagging and efficiency 93%. A bank of capacitors is now connected in delta across the supply terminals and power factor raised to 0.95 lagging. Determine the value of the capacitance connected in each phase.
(b) Draw the constructional diagram of an underground cable. 5+3
