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Total Number of Pages: 02

B. Tech/ IDD (B.Tech and M.Tech)  
REL5C001

5<sup>th</sup> Semester Regular/Back Examination: 2024-25  
ELECTRIC POWER TRANSMISSION & DISTRIBUTION  
EEE, ELECTRICAL, EE

Time: 3 Hours

Max Marks: 100

Q Code: R391

Answer all questions of Part-I, any 08 questions of (Part-II) and any two from Part-III.  
The figures in the right hand margin indicate marks.

Part- I

Q1 Objective Answer Type Questions (Answer All)

(2 x 10)

- What is most common generating voltage in India? Why are the generating voltages stepped up before transmission of power over long distances?
- What is ACSR conductor? Explain briefly.
- The voltages at the two ends of a line are 132 kV and its reactance is 40 ohms. What is the capacity of the line in MW?
- What is method of images? Briefly explain for the calculation of capacitance of transmission lines.
- The surge impedance of a 3-phase, 400 kV transmission line is  $400 \Omega$ . Find the surge impedance loading (SIL).
- What is stringing chart? Why is it useful? Explain briefly.
- The ABCD constants of a 3-phase transmission line are  $A = D = 0.8 \angle 1^\circ$ ;  $B = 170 \angle 85^\circ$ ;  $C = 0.002 \angle 90.4^\circ$  mho. The sending end voltage is 400 kV. Find the receiving end voltage under no load condition.
- Compare Hydroelectric Power Generation, Thermal Power generation and Nuclear power generation in terms of their gestation period.
- State the advantages of ring main distribution system over radial distribution system
- The currents in a 3-phase unbalanced system are:  $I_R = (12 + j6)$  A;  $I_Y = (12 - j12)$  A;  $I_B = (-15 + j10)$  A. The phase sequence is RYB. What is the zero phase sequence component in R-phase? Briefly explain.

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any Eight)

(6 x 8)

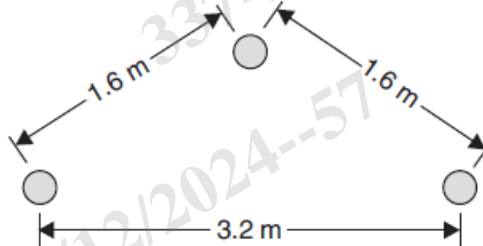
- Write a short note on- Nuclear Power Generation.
- What will be the equivalent radius of a bundle conductor having its part conductors of radius 'r' on the periphery of a circle of dia 'd' if the number of conductors is 2, 3, 4, 6?
- Explain clearly the 'skin effect' and 'proximity effect' when referred to overhead lines.
- A 400 V, 3-phase 4-wire service mains supplies a star connected load. The resistance of each line is 0.1 ohm and that of neutral 0.2 ohm. The load impedances are  $Z_R = (6 + j9)$ ,  $Z_Y = 8$  ohms and  $Z_B = (6 - j8)$ . Calculate the voltage across each load impedance and current in the neutral. Phase sequence RYB.

- e) Justify the need of capacitors in distribution systems.
- f) An overhead line has the following data: Span length 160 metres, conductor dia 0.95 cm, weight per unit length of the conductor 0.65 kg/metre. Ultimate stress 4250 kg/cm<sup>2</sup>, wind pressure 40 kg/m<sup>2</sup> of projected area. Factor of safety 5. Calculate the sag.
- g) Describe the vibration of power conductors and the methods used to damp out these vibrations.
- h) The line-to-ground voltages on the high voltage side of a step-up transformer are 100 kV, 33 kV and 38 kV on phases *a*, *b*, and *c* respectively. The voltage of phase-*a* leads that of phase-*b* by 100° and lags that of phase-*c* by 176.5°. Determine analytically the symmetrical components of voltage.
- i) Derive an expression for Sag of a line supported between two supports of same height.
- j) Compare overhead lines with underground cables.
- k) What is Kelvin's Law? State the limitations of Kelvin's Law.
- l) Determine the insulation resistance of cable and find the condition for maximum value of electrostatic stress in a single core cable.

### Part-III

#### Long Answer Type Questions (Answer Any Two)

- Q3** a) Explain the concept of self GMD and mutual GMD for evaluating inductance of transmission lines. **(4+6+6)**
- b) Determine the inductance of a 3-phase line operating at 50 Hz and conductors arranged as shown below. The conductor diameter is 0.8 cm.



- c) Determine the capacitance and the charging current per km when the transmission line shown above is operating at 132 kV.
- Q4** How the transmission lines are categorized on the basis of its length? Explain each of these transmission lines with its equivalent circuit and phasor diagrams. **(16)**
- Q5** a) Determine the voltage across each disc of suspension insulators as a percentage of the line voltage to earth. The self and capacitance to ground of each disc is  $C$  and  $0.2C$  respectively. The capacitance between the link pin and the guard ring is  $0.1C$ . **(8+8)**
- b) If the capacitance to the line of the lower link pin were increased to  $0.3C$  by means of a guard ring, determine the redistribution of voltage. Also determine the string efficiency in each case.
- Q6** a) Develop an equivalent network showing the interconnection of sequence networks to simulate a double line to ground fault. **(8+8)**
- b) Explain under-ground cables, their types and construction.