BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE **SEMESTER: VII**
BRANCH: EEE **SESSION: MO/2018**

SUBJECT: EE8217 EHV POWER TRANSMISSION

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Prove that- $R_{eq} = (6.r.R^5)^{\frac{1}{6}}$,Where R_{eq} is the Geometrical Mean radius for bundle of 6 sub-conductors having bundle radius R and bundle spacing B. Give ten levels of transmission Voltages that are used in the world. [2]

(b) Consider a matrix [A]given below: [2]

$$[A] = \begin{pmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{pmatrix}$$

Diagonalize the above matrix [A].

(c) Give ten levels of transmission Voltages that are used in the world. [1]

Q2 (a) Explain about field of sphere gaps for measurements of extra high voltages. [2]

(b) Deduce Mangoldt formulae for the outer phases in case of 3-phase ac line with horizontal configuration of phase and mention its significance. [3]

Q3 (a) What factors affect the power handling capacity of a EHV lines? [2]

(b) For low loss Quarter wavelength Transmission line calculate the A, B, C, D constants in terms of Vs, Vr, Is, Ir, Z0 & β and prove that- $\sqrt{Z_S \times Z_R} = Z_0$, where terms have own standard meanings. Also explain with figure- (1) The TCR-FC scheme. [3]

Q4 (a) A 400-kV line is 800 km long. Its inductance and capacitance per km are l=1mH/km & c=11.1nF/km (Z_{00}=300 ohms). The voltages at the two ends are to be held at 400 kV at no load. Neglect resistance. (Use 6^0/100 km.). Calculate- (1) MVAR of shunt reactors to be provided at the two ends and at an intermediate station midway with all four reactors having equal reactance. (2) The A, B, C, D constants for the entire line with the shunt reactors connected. [3]

(b) Consider shunt reactor compensation of very long transmission line with shunt reactors at ends and at intermediate station. Assume $B_{sh} \to 1$. Calculate total resultant generalized constant for the entire system is $\begin{pmatrix} A_T & B_T \\ C_T & D_T \end{pmatrix} B_{sh} = 1$ [3]

Q5 (a) In case of Transmission line with series capacitor compensation at line centre for voltage control, Prove that the generalized constants for the entire system is- [2]

$$\begin{pmatrix} A_T & B_T \\ C_T & D_T \end{pmatrix} = \begin{pmatrix} A + (\frac{X_C}{2Z_0}) Sin\beta l & B - jX_C Cos^2(\frac{\beta l}{2}) \\ C + j\frac{X_C}{Z_0^2} Sin^2(\frac{\beta l}{2}) & D + (\frac{X_C}{2Z_0}) Sin\beta l \end{pmatrix}$$

where X_C is reactance of capacitor and all remaining term have own standard meanings. Assume low loss condition of transmission line.

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(b) Using the property of transmission line with shunt reactor compensation for voltage control at no load (Assume $|E_S| = |E_R| = E$)& $B_{Sh} = 2$) .Prove that- $\left|\frac{B}{(A-1)}\right| = 0.5$, where terms have own standard meanings [3]

Q6 (a) Write short technical notes on <u>any TWO</u> of the following- [2.5x2]

i. Corona phenomenon, corona loss and methods of its reduction.
ii. Neutral grounding System& charge matrix.
iii. Surface Voltage gradient on conductors.

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