CBCS SCHEME

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16/17EPS151

First Semester M.Tech. Degree Examination, June/July 2019
EHV AC Transmission

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain (i) Aeolian vibrations (ii) Galloping (iii) Wake induced oscillations. Describe the measures taken to minimize the damage due to them **(12 Marks)**

b. A power of 12,000 MW is required to be transmitted over a distance of 1000 km. At voltage levels of 400 kV, 750 kV, 1000 kV, 1200 kV determine :

(i) Possible number of circuits required with equal magnitudes for sending and receiving end voltages with 30° phase difference.

(ii) The currents transmitted.

(iii) Total line loss.

Unit capacitor compensation x and r values given:

System voltage (kV)	400 kV	750 kV	1000 kV	1200 kV
R, Ω/km	0.031	0.0136	0.0036	0.0027
X, Ω/km (50 Hz)	0.327	0.272	0.231	0.231

(04 Marks)

OR

2 a. With usual notations, obtain an expression for the Geometric Mean Radius (GMR) of a bundled conductor. **(08 Marks)**

b. The diameter of a 3-phase 400 kV, transmission (horizontal) line are H = 15 m; s = 11m phase separation; conductor 2×3.18 cm diameter and B = 45.72 cm. Calculate

(i) The matrix of inductances/km, for untransposed configuration.

(ii) The matrix inductances/km, when there is complete transposition. **(08 Marks)**

Module-2

3 a. Given a positive charge Q_1 and a sphere of radius R with Q_1 located external to the sphere, whose centre is at a distance S_1 from Q_1, show that the sphere can be made to have zero potential on its surface if a charge of opposite polarity and magnitude $Q_2 = (Q_1 R / S_1)$ is placed at a distance, $S_2 = R^2/S_1$ from the center of given sphere towards Q_1. **(12 Marks)**

b. Calculate the voltage gradient at X = 0.25m for the sphere gap with distance between the centre of the spheres as 1 mtr of the gap between their surfaces is 0.5 mtr. Radius of spheres being 0.25 mtr each. $Q_1 = \pi e_0 : e_0 = \frac{1}{36\lambda} \times 10^{-9}$ F/m. **(04 Marks)**

OR

4 a. The dimensions of a ±400 kV dc line are shown in Fig.Q4(a) below. Calculate

(i) The charge coefficient $Q/2\pi e_0$ for each bundle.

(ii) The maximum and minimum surface gradient on the conductors by

(a) Omitting the charges of the seconds pole & image conductors.

(b) Considering the charge of the second pole but omitting the charge of the image conductors.

(iii) The average maximum surface voltage gradient of the bundle under case (ii)(b). **(08 Marks)**

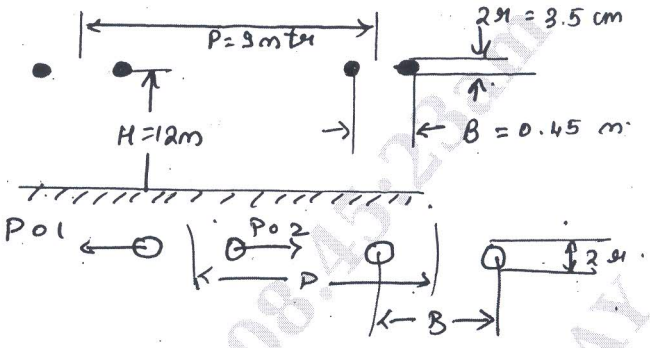

Fig.Q4(a)

b. Derive Mangoldt (Markt - Mengele) formula. **(08 Marks)**

Module-3

5 a. What are corona-loss formulae? Write expression for corona loss relations based on voltages and voltage gradients. **(10 Marks)**

b. For conductor of radius 1 cm, at a height of 5 m above ground with frequency of 50 Hz, calculate corona loss P_c, according to Peek's formula, when $E = 1.1E_0$ and $\sigma = 1$. **(06 Marks)**

OR

6 a. Explain transient response of systems with series and shunt lumped parameters and distributed line. **(10 Marks)**

b. An overhead line with $Z_0 = 400\ \Omega$. Continues into a cable with $Z_c = 100\ \Omega$. A surge with a crest value of 1000 kV is coming towards the junction from the overhead line. Calculate the voltage in the cable. If the end of the cable is connected to a transformer whose impedance is practically infinite to a surge, when the bushing capacitance is omitted. Calculate the transformer voltage. **(06 Marks)**

Module-4

7 a. Explain general principles of the lighting protection problem. **(08 Marks)**

b. A 400 kV horizontal line has 22 discs in the insulator and two ground wires spaced 15 mtrs apart at 20m height at mid-span and 26m at the tower. The tower footing resistance is 40 Ω. The surge impedances are : Ground wire = 500 Ω, Stroke = 400 Ω. Assume 60% of strokes to contact within ¼ span of line from the tower and at the top of tower. The coupling factor between ground and phase conductor is 0.2 and the factor is N_s is 0.2. The isokeraunik level is 60 thunderstorm days per year. Calculate the number of tripouts per year per 100 km of line. **(08 Marks)**

OR

8 a. Discus the types and origin of overvoltages in EHV systems. **(08 Marks)**

b. Explain different measures adopted in EHV system to reduce over voltage magnitudes. **(08 Marks)**

Module-5

9 a. Explain various static VAR compensators for reactive power control in EHVAC system. **(10 Marks)**

b. Elaborate on power circle diagram and its use. **(06 Marks)**

OR

10 a. Discuss in detail, different design factors of EHVAC lines under steady state condition. **(08 Marks)**

b. Explain line insulation design based upon transient overvoltages in EHVAC system. **(08 Marks)**

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