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B.TECH
(SEM V) THEORY EXAMINATION 2017-18
ELEMENTS OF POWER SYSTEM

Time: 3 Hours   **Total Marks: 100**

Note: 1.   Attempt all Sections. If require any missing data; then choose suitably.
2.   Any special paper specific instruction.

SECTION A

1.   Attempt all questions in brief.   **2 x10 = 20**

a. What is the difference between circuit breaker and isolator?
b. Explain skin effect.
c. What is a bundled conductor?
d. What is self GMD?
e. Define critical disruptive voltage.
f. What do you mean by the failure of insulator?
g. Explain stringing chart, why it is used.
h. On what factors does the insulation resistance of a power cable depends?
i. What is the need of grounding in power system.
j. What are the problems associated with the EHV transmission?

SECTION B

2.   Attempt any three of the following: **10 x 3 = 30**

a. What is electric power supply system? Compare the volume of conductor material required for a d.c. 3-wire system and 3-phase, 3-wire system on the basis of equal maximum potential difference between one conductor and earth. Make suitable assumptions

b. Using rigorous method, derive expressions for sending end voltage and current for a long transmission line.

c. 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.

d. What is a sag in overhead lines ? Deduce an approximate expression for sag in overhead lines when (i) supports are at equal levels (ii) supports are at unequal levels.

e. Explain HVDC transmission and its advantages and disadvantages. Also classify the DC transmission links.

SECTION C

3.   Attempt any two part of the following: **5 x 2 = 10**

(a) State and prove Kelvin's law for size of conductor for transmission. Discuss its limitations

(b) Draw and explain a single line diagram of a typical power system.

(c) A D.C. 2-wire system is to be converted into A.C. 3-phase, 3-wire system by the addition of a third conductor of the same cross-section as the two existing conductors. Calculate the percentage additional load which can now be supplied if the voltage between wires and the percentage loss in the line remain unchanged. Assume a balanced load of unity power factor.

4. **Attempt any two part of the following:** **5 x 2 = 10**

(a) Derive an expression for the inductance per phase for a 3-phase overhead transmission line when (i) conductors are symmetrically placed (ii) conductors are unsymmetrically placed but the line is completely transposed

(b) Show how regulation and transmission efficiency are determined for medium lines using nominal T method .Illustrate your answer with suitable vector diagrams.

(c) Calculate the capacitance of a 100 km long 3-phase, 50 Hz overhead transmission line consisting of 3 conductors, each of diameter 2 cm and spaced 2·5 m at the corners of an equilateral triangle.

5. **Attempt any two part of the following:** **5 x 2 = 10**

(a) What is corona? What are the factors which affect corona? How it can be reduced?

(b) A 3-phase line has conductors 2 cm in diameter spaced equilaterally 1 m apart. If the dielectric strength of air is 30 kV (max) per cm, find the disruptive critical voltage for the line. Take air density factor $\delta = 0·952$ and irregularity factor mo = 0·9.

(c) Show that in a string of suspension insulators, the disc nearest to the conductor has the highest voltage across it.

6. **Attempt any two part of the following:** **5 x 2 = 10**

(a) Why grading is required in insulated cables? Explain any one method of cable grading.

(b) A transmission line has a span of 150 m between level supports. The conductor has a cross-sectional area of 2 cm2 . The tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9·9 gm/cm3 and wind pressure is 1·5 kg/m length, calculate the sag. What is the vertical sag?

(c) A single core cable for use on 11 kV, 50 Hz system has conductor area of 0·645 cm 2 and internal diameter of sheath is 2·18 cm. The permittivity of the dielectric used in the cable is 3·5. Find (i) the maximum electrostatic stress in the cable (ii) minimum electrostatic stress in the cable (iii) capacitance of the cable per km length (iv) charging current.

7. **Attempt any one part of the following:** **10 x 1 = 10**

(a) Explain the following method of neutral grounding (i) solid grounding (ii) Peterson coil grounding (iii) resistance grounding

(b) (i) Compare the HVDC and and HVAC transmission.
(ii) Explain surge impedance loading.