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S.E. (Elect. Engg.) (Second Semester) EXAMINATION, 2011

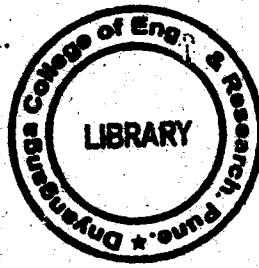
POWER SYSTEM-I
(2008 PATTERN)

Time : Three Hours

Maximum Marks : 100

- N.B. :**— (i) Answer *three* questions from each Section.
(ii) Answers to the two Sections should be written in separate answer-books.
(iii) Neat diagrams must be drawn wherever necessary.
(iv) Figures to the right indicate full marks.
(v) Your answers will be valued as a whole.
(vi) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(vii) Assume suitable data, if necessary.

SECTION I



1. (a) Define the following terms associated with load characteristics :
(i) Load factor
(ii) Demand factor
(iii) Diversity factor
(iv) Annual plant use factor. [8]
(b) What are the objectives of tariff ? Explain the role of incentives and penalties to encourage the customers to keep load factor and power factor high. [8]

P.T.O.

Or

2. (a) What do you understand by load curve and load duration curve ? What information is obtained from them ? [6]

(b) The maximum demand on a power plant is 60 MW. The plant capacity factor is 0.6 and the utilization factor is 0.8. Find :

(i) Load factor

(ii) Plant capacity

(iii) Reserve capacity

(iv) Annual energy production. [6]

(c) Write a short note on time of day tariff. [4]

3. (a) Write a short note on PLCC equipment. [6]

(b) Derive the expression for voltage distribution across the unit

of a string of suspension insulators. Define string efficiency.

Name only any two methods used for improving the string efficiency. [10]

Or

4. (a) Write a note on control room equipments in a generating station. [8]

- (b) Each line of a three-phase system is suspended by a string of three similar insulators. If the voltage across the line unit is 18 kV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $(1/10)$ th of the capacitance of the insulator itself. Also find the string efficiency. [8]
5. (a) Derive the expression for inductance per phase of a three-phase overhead transmission line with unsymmetrical spacing between conductors (with transposition). [8]
- (b) Find the inductive reactance/ph/km of a double circuit three-phase transmission line as shown in Fig. 1. The conductors are transposed and radius of each is 0.7125 cm. The frequency is 50 Hz. [10]

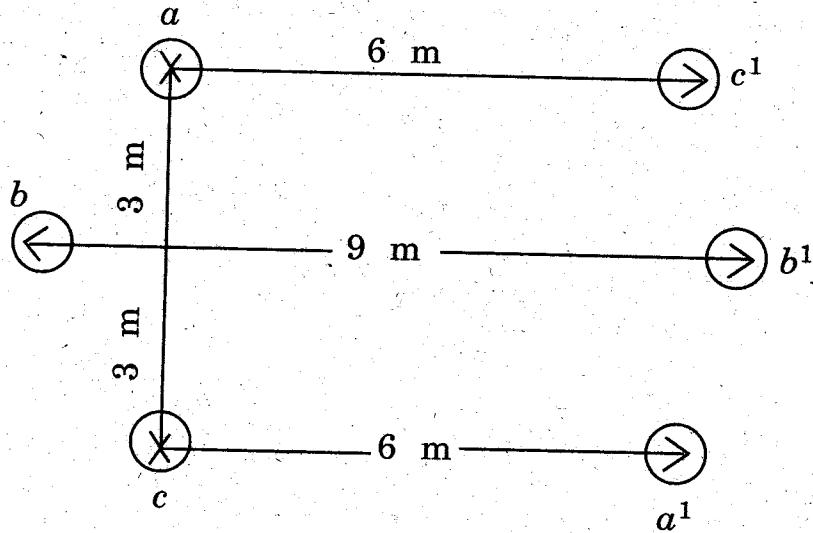


Fig. 1

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P.T.O.

Or

6. (a) Write a short note on skin effect. [6]
- (b) Explain the concept of GMD and GMR. [6]
- (c) A three-phase 50 Hz overhead transmission line consists of three conductors each of diameter 25 mm. The spacing between the conductors is as follows :

$$A - B = 3 \text{ m}, B - C = 5 \text{ m}, C - A = 3.2 \text{ m.}$$

Find the inductance and inductive reactance per phase per km of the line. [6]

SECTION II

7. (a) Derive expressions for line-to-line capacitance and line-to-neutral capacitance for a single-phase overhead transmission line. [8]
- (b) A 50 Hz overhead transmission line consisting of three conductors each of diameter 2 cm and spaced 2.5 m. Calculate the capacitance per phase per km for the following arrangement between conductors :
- (i) Equilateral spacing
 - (ii) Horizontal spacing with transposition. [8]

Or

8. (a) Derive an expression for the capacitance to neutral of a three-phase line with equilateral spacing. [8]

- (b) A 40 km long, single-phase line has two parallel conductors each 5 mm in diameter and 1.5 m apart. The height of conductors above ground is 7 m. Find the capacitance of the line :
- Neglecting the effect of earth
 - Including the effect of earth.
- [8]

9. (a) Give classification of transmission lines based on length. Explain the influence of power factor on the performance of a transmission line. [8]

- (b) Derive the expression for ABCD constants of a long transmission line in hyperbolic form. [8]

Or

10. (a) Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with nominal pi method. Draw the phasor diagram. [8]

- (b) Calculate ABCD constants for a three-phase, 50 Hz, long transmission line with the following parameters :

$$R = 24 \Omega$$

$$L = 0.192 \text{ H}$$

$$C = 1.28 \times 10^{-6} \text{ F}$$

$$G = 0.$$

[8]

11. (a) Derive an expression for sag and tension of a overhead transmission line supported between the towers of the same height. [10]

- (b) A 33 kV, three-phase, 50 Hz underground cable is 4 km long. It uses three-single core cables where each cable has a core diameter of 2.25 cm and the radial thickness of insulation is 0.6 cm. The relative permittivity of the dielectric is 3. Find :

(i) Capacitance of the cable/phase

(ii) Maximum stress in the cable.

[8]

Or

12. (a) Write a short note on XLPE cables. [6]

- (b) Explain different types of cable faults. [6]

(c) A transmission line has a span of 180 m between level supports.

Line conductor has a cross-sectional area of 1.3 cm^2 and it weighs 1 kg/m. If the breaking stress of conductor is 4000 kg/cm^2 . Calculate the maximum sag for a safety factor of 4.

Assume a maximum wind pressure of 100 kg/m^2 of the projected surface.

[6]