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RN-6805

B. E. - III (Sem. V) (Electrical) Examination

May / June – 2010

Electrical Power System - I

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

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 3 (Sem. 5) (Electrical)**

Name of the Subject :

☛ **Electrical Power System - 1**

☛ Subject Code No. : **6 8 0 5** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answers to the **two** sections must be written in **separate** answer books.
(3) Figures on right hand side indicate full marks.
(4) Assume suitable data wherever necessary.
(5) Attempt **all** questions.
(6) Calculator below 100 series is allowed.

SECTION - I

Q:1 (a) Answer the following questions in few lines: **(10)**

(1) What is the need for stranding the conductors?
(2) What is meant by the terms GMR & GMD?
(3) What is meant by transposition of line conductors?
(4) What is Ferranti effect?
(5) What is the surge impedance loading of a line?

Q:1 (b) The constants of a 275 KV,3 – Phase line are as follow: **(10)**

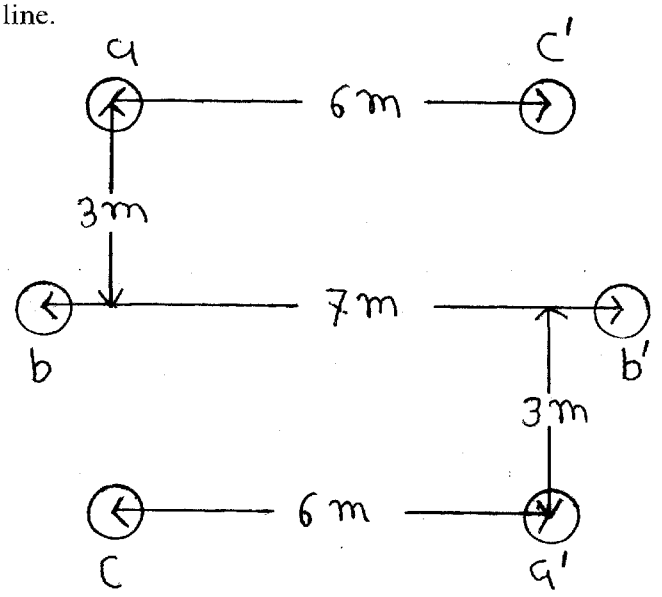
$A = 0.93\angle 1.5^\circ$ & $B = 115\angle 77^\circ\ \Omega$ / Phase

Draw receiving end power circle diagram & if the receiving end voltage is 275 KV determine :

(i) The sending end voltage required if a Load of 250 MW at 0.85 lagging p.f. is being delivered at receiving end.
(ii) The maximum power which the line can be delivered if the sending end voltage is held at 295 KV.

Q:2 (a) Derive the expression for inductance per phase of a three phase line with unsymmetrical spacing, assuming the line to be fully transposed. **(07)**

Q:2 (b) A part of the transposition cycle of a 3 –phase doubled circuit line is shown in figure. Radius of each conductor is 0.9 cm. The conductors are solid copper. Find the inductance per phase per km of line. **(08)**



OR

Q:2 (b) A three phase, 50 Hz transmission line, 100 Km long delivering 25 MW at 110 KV & a 0.85 p.f. lagging. The resistance & reactance of the lines per phase per Km are 0.3 Ω & 0.5 Ω respectively, While capacitive admittance is 2.5×10^{-6} mho / Km / phase. **(08)**
Calculate:
(1) Sending end Voltage
(2) Sending end Current
(3) Voltage regulation
(4) Line efficiency.
Also draw vector diagram. use nominal T method

Q:3 Attempt any **three**: **(15)**

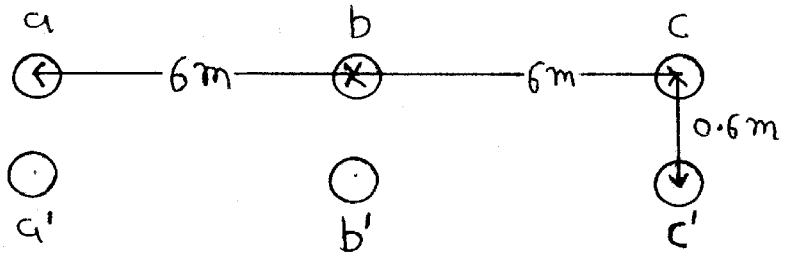
(a) What is Skin effect? Why is it absent in the DC system?

(b) Evaluate the generalized circuit constant for
  (i) short transmission line
  (ii) medium line - nominal Π method

(c) Describe the Synchronous Condenser method of Voltage Control for a transmission line. Illustrate the answer with vector diagram.

(d) Explain Tuned Power Lines.

(e) Determine the capacitance per km per phase of a doubled circuit three phase line as shown in figure. The radius of each conductor is 1 cm.



SECTION - II

4 (a) Fill in the blanks : **10**

(i) Transmission of electric power is normally done by _____.

(ii) The economic size of a conductor is determined by _____ law.

(iii) Void formation occurs in _____ cables.

(iv) The electrostatic stress in the ungrounded cable is _____ at the conductor and _____ at the sheath.

(v) When the potential across each disc is the same, then the string efficiency is _____%.

(vi) Purpose of guard ring is to _____ the string efficiency.

(vii) Formula for sag when supports at equal level is _____

(viii) String chart is useful in finding _____.

(ix) The advantages of corona is to _____, the conductor size.

(x) The dielectric strength of air in terms of maximum value is _____.

(b) Answer in one line : **5**

(1) What is meant by grading of cables ?

(2) What is VIR ?

(3) What is meant by guard ring ?

(4) Define span.

(5) Which type of supply system is normally used for transmission of large power ?

(c) Answer any **two** : **5**

(1) What is the advantage of corona ? Justify your answer.

(2) Type of three-phase AC system and their uses.

(3) Factors affecting sag in an overhead line.

5 (a) Show that the sag on level supported line conductor of span L, weight per unit length Wkg and minimum tension in the line conductor T_0 is given by $S = \frac{wL^2}{8T_o}$. **5**

(b) The capacitance per km. of a three-phase belted cable is $0.3 \mu F$ between the two cores with the third core connected to the lead sheath. Calculate the charging current taken by 5 km of this cable when connected to a 3-phase, 50 Hz, 11 kV supply. **5**

(c) A string of suspension insulator consists of four units. The voltage between each pin and earth is 1/10th of the self capacitance of the unit. The voltage between the line conductor and earth is 132 kV. Find the voltage distribution across each unit. **5**

OR

5 (a) Two towers of height 40 m and 90 m, respectively support a transmission line conductor at a water crossing. The horizontal distance between the towers is 500 m. If the allowable tension in the conductor is 1600 kg. Find the minimum clearance of the conductor and the clearance of the conductor midway between the supports. Wt. of the conductor is 1.1 kg/m. Bases of the towers can be considered to be at water level. **8**

(b) Show that in a cable transmission scheme the ratio of volumes of conductor in DC, two-wire, and AC single phase is $1 : \frac{2}{\cos^2 \phi}$ assuming same transmission loss in both cases for transmitting same power. **7**

6 Answer any **three** : **15**

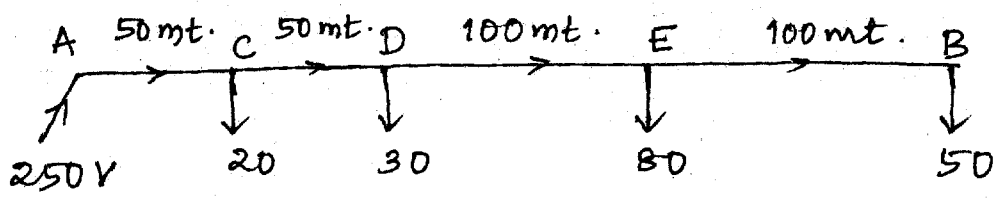
(a) Define corona and what are the effects of corona ?

(b) Derive the expression for economic core diameter for a fixed value of operating voltage and overall diameter of the cable.

(c) A 2-wire D.C. distributor supplies the following loads :

Load in Amps.	20	30	80	50
Dist. from supply end in (mts.)	50	100	200	300

If the supply end voltage is 250 V, calculate the voltage at the different load points. The resistance of distributor is $0.0001\ \Omega$ (ohm) per conductor per metre.



(d) Name the different methods of improving string efficiency and define string efficiency.