17695

15162

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory*.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

Marks

1. (A) Attempt any THREE of the following : **12**

(a) Draw basic structure of power system showing voltage levels.

(b) Describe influence of skin effect on line conductors.

(c) Define self GMD and mutual GMD.

(d) Classify power system stability.

(B) Attempt any ONE of the following : **06**

(a) Derive expression for inductance of three phase line composed of solid conductors with (i) symmetrical and (ii) Asymmetrical spacing.

(b) Describe steady state stability with the help of power angle curve.

2. Attempt any FOUR of the following : **16**

(a) Describe role of power system Engineer.

(b) Derive the expression for flux linkages of an isolated current carrying conductor due to internal flux only.

(c) Write stepwise procedure for measurement of generalized circuit constants.

(d) Derive the condition for maximum power flow at receiving end.

(e) Describe stepwise procedure to draw sending end circle diagram.

(f) List the data required to draw receiving end circle diagram.

3. Attempt any FOUR of the following : 16

(a) Differentiate between a.c. resistance and d.c. resistance.

(b) Find the loop inductance and reactance per km of a single phase overhead line consisting of two conductors, each 1.213 cm diameter. The spacing between conductors is 1.25 m and frequency is 50 Hz.

(c) Derive expression for potential difference between two conductors in a group of charged conductors.

(d) List the advantages of circle diagram.

(e) A 300 km, 3-phase overhead line has a series impedance of (11 + j106)Ω/phase and a shunt admittance of $1.13 \times 10^{-3} \angle 90°$ siemens per phase. The line delivers 250 MW at unity p.f. and at 275 kV. Determine GCC A and B of the line.

4. (A) Attempt any THREE of the following : 12

(a) Following figure-1 shows a generator feeding to two motors through transformers and line. The ratings and reactances are as follows :

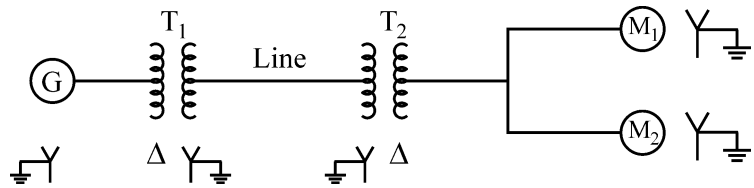

Fig. – 1

Generator : 100 MVA, 11 kV, 3 phase, X = 20%

Transformer T_1 : 3 phase 100 MVA, 11/132 kV, X = 50%

Transformer T_2 : 3 phase 35 MVA, 66/11 kV, X= 4%

Motor M_1 and M_2 : 40 MVA, 3 phase 10 kV, X = 20%

If the line reactance is 80 Ω, draw reactance diagram by selecting suitable base values.

(b) Determine self and mutual GMD for the circuit shown in following figure-2 with radius of each conductor as 1.5 cm.

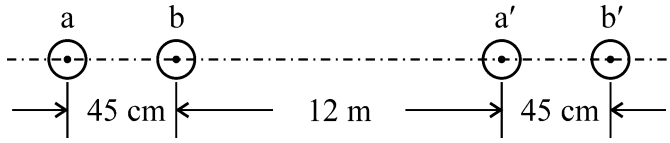

Fig. – 2

(c) Describe the concept of steady state stability and transient stability.

(d) State the adverse effects of instability.

(B) Attempt any one of the following : 06

(a) Calculate capacitance per km per phase and capacitive reactance per km per phase for a 3 phase, 50 Hz bundled conductor line shown in fig.- 3. Each sub-conductor has a diameter of 25 mm.

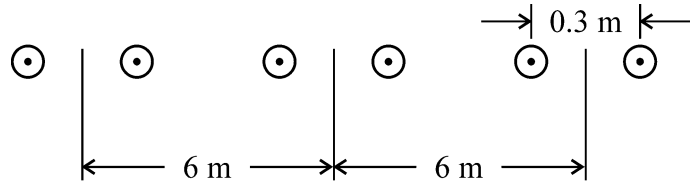

Fig. – 3

(b) Derive expression for complex power, real power and reactive power at sending end considering two bus system.

5. Attempt any TWO of the following : 16

(a) Derive expression for overall ABCD constants of two transmission line connected in series.

(b) A 3 phase overhead line has A = D = 0.9 $\angle 1°$ and B = 140 $\angle 84°$ ohm operated with V_s = 240 V and V_r = 220 V. Calculate (i) maximum power, which can be transferred to receiving end. (ii) Rating of synchronous phase modifier at receiving end if load at receiving end is 80 MW at 0.8 p.f. lagging.

(c) A 132 kV 3-phase line has constants A = 0.98 $\angle 3°$ and B = 110$\angle 75°$ ohms/phase. The line has $V_s = V_r$ = 132 kV. Draw receiving end circle diagram and determine (i) reactive vars which shunt compansation must supply if, load is 50 MVA, 0.8 lagging p.f. (ii) the maximum power which line can deliver.

6. Attempt any FOUR of the following : 16

(a) A 3-phase 132 kV, 100 km, 50 Hz single circuit line has horizontal spacing with 3.5 m between adjuscent conductors. The conductor diameter is 1.2 cm. Find the line capacitance per phase and charging current per phase.

(b) A 3-phase line has series impedance of $200\angle 80°\ \Omega$/phase and shunt admittance of $0.0013\angle 90°$ siemens/phase. The line supplies 90 MW at a voltage of 200 kV at 0.9 lagging p.f. Find sending end voltage and power angle considering nominal π circuit.

(c) Describe concept of stability with the help of simple two machine power system model.

(d) Derive the expression for maximum power flow under steady state condition.

(e) List the traditional methods of improving transient stability.

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