2062
B.E. (Electrical and Electronics Engineering)
Fourth Semester
PC-EE-402: Power Systems - I

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Missing data (if any) can be appropriate assumed.*

x-x-x

Q1.   **Explain in brief**

A) State all the advantages of per unit system used for calculation of power system parameters. **(2)**

B) Only draw the labeled diagrams of the insulators used in power system. **(2)**

C) Write all the effects of vibrations on overhead transmission lines. **(2)**

D) Explain line loadability. Can we increase the line loadability of the transmission line? Support our answer. **(2)**

E) Why the reactive compensation is required by the transmission line? Explain. **(2)**

Part A

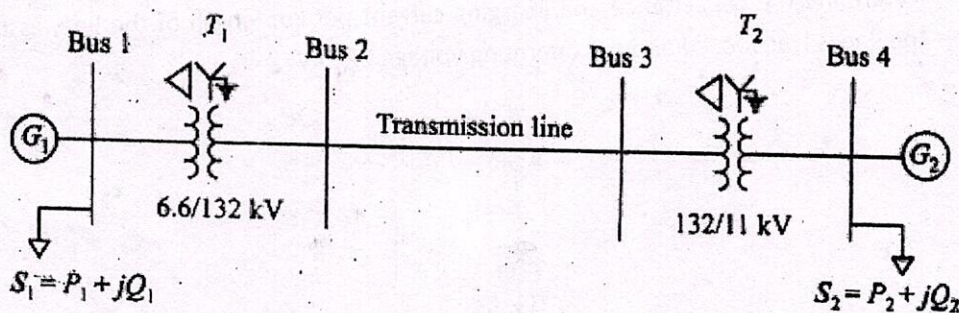**Q2. A)** The power system shown in Fig. 1 has the following specifications: **(5)**

Fig.1

Generator G_1: 20 MVA, 6.6 kV, $X_{G1} = 0.10$ pu

Generator G_2: 25 MVA, 11 kV, $X_{G2} = 0.20$ pu

Transformer T_1: 25 MVA, 6.6/132 kV, $X_1 = 0.08$ pu

Transformer T_2: 30 MVA, 11/132 kV, $X_2 = 0.10$ pu

Transmission line: Line-to-line voltage = 132 kV,

Impedance $Z = (30 + j\,120)$ Ω Load: $S_1 = 10$ MVA at 0.8 pf lagging and $S_2 = 25$ MVA at 0.9 pf leading.

Assuming $MVA_{base} = 50$ for the system, calculate the pu values of generators, transformers, transmission line, and load. Draw a single-line diagram and show the pu values of the system components.

B) What are ACSR conductors? Explain the advantages of ACSR conductors when used for overhead lines. **(5)**

Q3 A) Explain clearly the 'skin effect' and 'proximity effect' when referred to overhead lines. **(5)**

B) Determine the voltage across each disc of suspension insulators as a percentage of the **(5)**

line voltage to earth. The self and capacitance to ground of each disc is C and 0.2C respectively. The capacitance between the link pin and the guard ring is 0.1C. If the capacitance to the line of the lower link pin were increased to 0.3C by means of a guard ring, determine the redistribution of voltage. Also determine the string efficiency in each case.

Q4 A) Discuss the phenomenon of wave reflection and refraction. Derive expressions for reflection and refraction coefficients. **(5)**

B) Show that the sag on level supported line conductor of span L, weight for unit length W kg and minimum tension T in the line conductors is given by $S = Wl^2/ 8T$, what will be the sag if level difference is of 'h' meters. **(5)**

Part B

Q5 A) A three phase, 50 Hz line consists of three conductors each of diameter 21 mm. the spacing between the conductors is as follows: **(5)**
A-B = 3 m, B-C = 5 m, C-A = 3.6 m
Find the inductance and inductive reactance per phase per km of the line.

B) A 3-phase double circuit line is shown in Fig. 2. The diameter of each conductor is 2 cm. Determine the capacitance and charging current per km length of the line, assume that the line is transposed and the operating voltage 220 kV. **(5)**
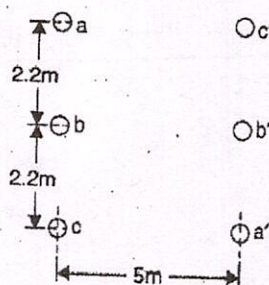

Fig.2

Q6 A) What are bundled conductors? Discuss the advantages of bundled conductors when used for overhead lines. **(5)**

B) Explain nominal pi model representation of medium transmission line with phasor diagram. **(5)**

Q7 Explain the reactive compensation techniques used in the overhead transmission lines in details with suitable diagrams. **(10)**

x-x-x