B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-V

TE104 - Power Systems I (Apparatus and Modelling)

P. Pages : 2 **GUG/W/23/13867**

Time : Three Hours * 7 4 5 4 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
6. Read the question paper carefully (Branch, Semester, Scheme) before attempting the questions.
7. Every question has equal weightage.
8. Use of programmable calculator is prohibited.
9. Draw neat and proper diagram/sketches.
10. Don't use red pen for writing the answers.
11. Don't write any other comments except answers of questions.

1. a) Explain the sample structure of modern power system with single line diagram. **8**

b) A 2-wire D.C street mains AB, 600m long is fed from both ends at 220V. Loads of 20A, 40A, 50A and 30A are tapped at distances of 100m, 250m, 400m and 500m from the end A respectively. If the area of cross-section of distributor conductor is 2 1cm, find the minimum consumer voltage. Take 6=1.7 10cm. **8**

OR

2. a) Explain conventional and nonconventional energy sources with along with the concept of distributed energy sources. **8**

b) A three phase line has impedance of 0.4+j 2.7 ohm. The line feeds balanced two three phase loads that are connected in parallel. The first load absorbs 560 kVA at 0.707 power factor lagging. The second load absorbs 132kVA at unity power factor. The line to line voltage at the end of the line is 3810.5 V. **8**

Determine;
i) The magnitude of the line voltage at source end of the line.
ii) The real and reactive power loss in the line.
iii) Real power and reactive power supplied at the sending end of the line.

3. a) Which factors governs the capacitance of a transmission line? Derive the expression for capacitance of $3-\varnothing$, unsymmetrical placed transposed lines. **8**

b) A 15000 KVA load is received at 33 KV & 0.85 p.f. lagging, over 8 km. 50 Hz, 3-phase transmission line, find **8**
i) Sending end voltage, current & p.f.
ii) Voltage regulation.
iii) Transmission efficiency. Given that Resistance & Reactance of each conductor is $2.32\,\Omega$ & 5.20. Ohms respectively.

OR

4. a) Derive the formulae for obtaining active & reactive powers at sending end & receiving end of transmission line in terms of its generalized constants. **8**

b) Derive the equation of voltage regulation of short transmission line. Obtain the condition for zero voltage regulation. **8**

5. a) Explain the mechanism of lightning strokes including high over voltages on transmission line. **8**

b) Explain various methods to control switching over voltages. **8**

OR

6. a) Draw a cross sectional views of a non- linear resistor lightning arrestor and explain its operation. Give a typical of L.A. **8**

b) What is meant by insulation coordination? Explain its application to power system equipment. **8**

7. a) Derive the equation of transmission line impedances in terms of symmetrical components. Show that zero sequence impedance greater than positive and negative sequence impedance. **8**

b) Explain different types of circuit breaker in brief as per arc extinguishing media. State advantages and disadvantages each one. **8**

OR

8. a) Determine the symmetrical components of current in a three phase system. The original phasors are: **8**

$I_a = 12 + j8A$

$I_a = 12 - j6A$

$I_a = -12 + j6A$

b) Draw and explain zero sequence network in the following cases. **8**

i) y-y transformer bank with one natural grounded.
ii) y-y transformer bank with both natural grounded.
iii) Delta – Delta transformer bank.

9. a) What is the need for interconnection of systems? Explain the merits of connecting HVAC systems by HVDC tie-lines? **8**

b) Write short notes on **any two.** **8**

i) Explain the working principle of a solar cell.
ii) Explain the construction of a solar cell with a neat figure.
iii) Write down clearly all the important concepts of Solar cells.

OR

10. a) With the help of a neat schematic diagram of a typical HVDC converter station explain the functions of various components available. **8**

b) Explain the effects of Wind Generator on the grid with the help of a simple equivalent circuit and a phasor diagram. **8**

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