Code No: 155CV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February - 2022
POWER SYSTEM – II
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Derive the expression for regulation and efficiency of a medium transmission line using nominal π method. Draw phasor diagram also.
b) Input to a single-phase short line is 2000 KW at 0.8 pf lagging. The line has a series impedance of (0.4 + j0.4) ohms. If the load voltage is 3 KV, find the load and receiving end power factor. Also find supply voltage and supply power factor. [7+8]

2.a) Discuss why equivalent π circuit of a long line is preferred over the equivalent T circuit.
b) A three phase 50 Hz transmission line is 150 km long and delivers 25 MW at 0.85 power factor lagging and at 110 KV. The resistance and reactance of the line per conductor per km are 0.3 ohms and 0.9 ohms respectively. The line charging admittance is 0.3×10^{-6} mho per km per phase. Compute by applying the nominal π method the voltage regulation and transmission efficiency. [6+9]

3.a) Explain the working of on-load tap changing transformer for voltage control.
b) A 3-phase line has an impedance of (20 + j60) ohm per phase. The sending end voltage is 142 kV while the receiving end voltage is maintained at 132 kV for all loads by an automatic phase modifier. If the kVAr of the modifier has the same value for zero load as for a load of 70 MW, determine the rating of the modifier and the p.f. of this load. [7+8]

4.a) Explain series and shunt compensation of lines and discuss their effect on the surge impedance loading of the lines. If shunt compensation is 100%, what happens to SIL and voltage profile?
b) A radial long uncompensated line with constant sending end voltage is terminated through an asynchronous load, derive an expression for maximum power transfer when termination is through a variable resistance. Hence discuss the voltage instability problem. [7+8]

5.a) Explain the p.u. system of analysing power system problems. Discuss the advantages of this method over the absolute method of analysis.
b) Two generators rated at 10 MVA, 13.2 kV and 15 MVA, 13.2 kV are connected in parallel to a busbar. They feed supply to two motors of inputs 8 MVA and 12 MVA respectively. The operating voltage of motors is 12.5 kV. Assuming base quantities as 50 MVA and 13.8 Kv, draw the reactance diagram. The percent reactance for generators is 15% and that for motors is 20%. [7+8]

6.a) Using Bewley's Lattice diagram, represent the voltage and current waveforms of a short-circuited line.

b) An overhead line with surge impedance 400 ohms bifurcates into two lines of surge impedance 400 ohms and 40 ohms respectively. If a surge of 20 kV is incident on the overhead line, determine the magnitudes of voltage and current which enter the bifurcated lines. [7+8]

7. Describe the construction, principle of operation and applications of
a) Expulsion gap; and
b) Valve type lightning arrester. [7+8]

8.a) Derive an expression for the fault current for a double line to ground fault as an unloaded generator and draw its equivalent circuit.

b) A generator rated 120MVA, 11kV has $X = X_2 = 30\%$ and $X_0 = 15\%$. Its neutral is grounded through a reactance of 0.1Ω. The generator is operating at rated voltage, load is disconnected from the system when double line to ground fault occurs at its terminals. Find the sub-transient current in the faulted phases and line to line fault current. [8+7]

---ooOoo---