CBCS SCHEME

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15EE62

# Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
## Power System Analysis – I

Time: 3 hrs. Max. Marks: 80

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**



### Module-1

1 a. Show that the per unit impedance of a transformer is the same when referred to either primary or secondary side. **(04 Marks)**

b. Draw the circuit model of synchronous generator, transmission lines and transformer. **(04 Marks)**

c. The OLD of an unloaded power system is as shown in Fig.Q1(c). Reactance of Tr. Line are shown in figure. Draw the per unit impedance diagram. Choose a base of 50 MVA. 13.8 KV in G, circuit. The ratings are as under.

$G_1 \rightarrow$ 20 MVA, 13.8 KV, X″ = 0.2Pu, $T_1 \rightarrow$ 25MVA, 220/13.8 KV, X = 10%

$G_2 \rightarrow$ 30 MVA, 18 KV, X″ = 0.2Pu, $T_2 \rightarrow$ 3, 1ϕTr% each 10 MVA, 127/18 KV, X = 10%

$G_3 \rightarrow$ 30 MVA, 20 KV, X″ = 0.2Pu, $T_3 \rightarrow$ 35MVA, 220/22 KV, X = 10%. **(08 Marks)**

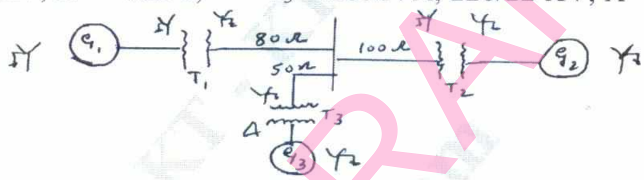


Fig.Q1(c)

**OR**

2 a. What is per unit quantity? Mention its advantage. **(04 Marks)**

b. How is the per unit impedance value in a given base are changed to per unit impedance value on new base. **(04 Marks)**

c. Draw the impedance diagram for the power system shown in Fig. Q2(c). The ratings of the components are as under,

$G_1 \rightarrow$ 25 MVA, 11 KV, x = 15% $G_2 \rightarrow$ 30 MVA, 12.5 KV, x = 20%

$M_1 \rightarrow$ 15 MVA, 11 KV, x = 12% $M_2 \rightarrow$ 25 MVA, 11.5 KV, x = 15%

$T_1 \rightarrow$ 30 MVA, 13/132 KV, x = 25% $T_2 \rightarrow$ 35 MVA, 132/11 KV, x = 20%

Choose a base of 132 KV on (100 + j150)Ω Tr. Line at 30 MVA base. **(08 Marks)**

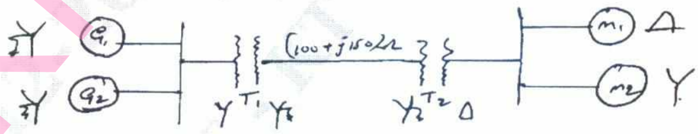


Fig.Q2(c)

### Module-2

3 a. With the help of oscillogram of short circuit current of a synchronous generator operating on no load distinguish between subtransient, transient and steady state reactances. Also show that $X_d'' < X_d' < X_d$ with equivalent circuit diagram. **(08 Marks)**

b. A generator is connected to a synchronous motor through transformer. Reduced to a common base, the per unit subtransient reactance of generator and motor are 0.15 and 0.35 respectively. The leakage reactance of the transformer 0.1 pu. A 3ϕ short circuit fault occurs at terminals of the motor when terminal voltage of generator is 0.9 Pu, and output current of the generator is 1pu at 0.8 pf leading. Find the sub transient current in the fault, generator and motor. **(08 Marks)**

OR

4 a. Explain clearly how circuit breakers are rated. **(04 Marks)**

b. For the radial network shown in Fig.Q4(b), a 3ϕ fault occurs at 'F'. Determine the fault current. Choose a base of 100 MVA and base KV of 33 KV in overhead transmission line. **(12 Marks)**

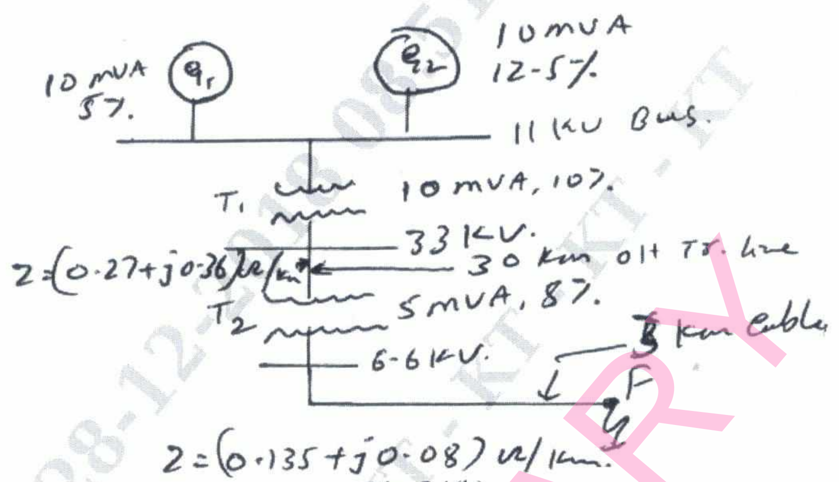


Fig.Q4(b)

## Module-3

5 a. Derive an expression for the 3ϕ, complex power in terms of symmetrical components. **(08 Marks)**

b. Draw the zero sequence network for different combination of 3ϕ transformer bank. **(04 Marks)**

c. A balanced Δ connected load is connected to a 3ϕ symmetrical supply. The line currents are each 10A in magnitude. If fuse in one of the line is blown out. Determine the sequence component of the line current. **(04 Marks)**

OR

6 a. Derive an expression for symmetrical components of voltage in terms of phase voltage. **(06 Marks)**

b. Draw the positive, negative and zero sequence network for the power system shown in Fig.Q6(b). Choose a base of 50MVA, 220KV in the 50Ω transmission line and mark all reactance in per unit. The ratings are as under :
$G_1 \rightarrow$ 25 MVA, 12 KV, X″ = 20%, $G_2 \rightarrow$ 25MVA, 11KV, X″ = 20% $T_1$ to $T_4 \rightarrow$ 20MVA. 11/220 KV, X = 15%.
The negative sequence reactance of each synchronous machine is equal to the subtransient reactance. The zero sequence reactance of each machine is 8%. Assume that the zero sequence reactance of line are 250% of their positive sequence reactance. **(10 Marks)**

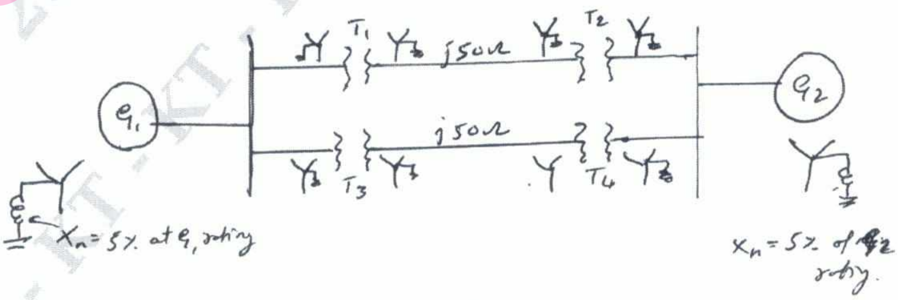


Fig.Q6(b)

## Module-4

7 a. A double line to ground fault occurs at the terminals of an unloaded generator. Derive an expression for fault current, Draw the connection of sequence network. **(06 Marks)**

b. A 25MVA, 11KV, 3ϕ generator has a subtransient reactance of 20%. The generator suppliers 2 motor over transmission lines with transformer at both ends as shown in Fig.Q7(b). The motors have rated input of 15 MVA and 7.5MVA, both 10 KV, with 25% subtransient reactance. The 3ϕ transformer are both rated 30MVA, 10.8/121KV, ΔY, with leakage reactance of 10% each. The series reactance of the line is 100Ω. Calculate the fault current when a LG fault occurs at F. The motors are loaded to draw 15 MVA and 7.5MVA at 10KV and 0.8pf leading. Assume that negative sequence reactance is equal to positive sequence reactance. The zero sequence reactance are marked in the Fig.Q7(b). **(10 Marks)**

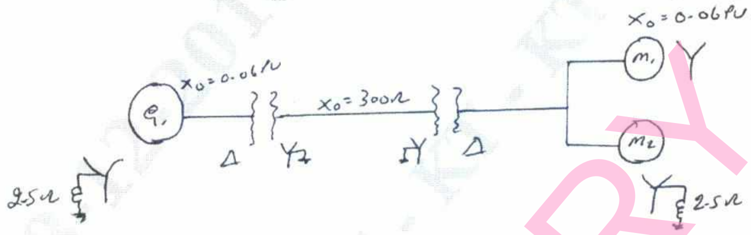


Fig.Q7(b)

**OR**

8 a. Derive an expression for fault current if LL fault occurs through a fault impedance $Z_f$ in a power system. Show the connection of sequence network to represent the fault. **(06 Marks)**

b. A 3ϕ, 50MVA, 11KV, star connected neutral solidly grounded generator operating on no load at rated voltage give the following fault currents for the fault specified.
3ϕ fault → 2000A, LL fault-1800A, LG fault 2200A. Determine the 3 sequence reactance in ohm and per unit. **(10 Marks)**

## Module-5

9 a. Derive swing equation for a synchronous reactance. **(08 Marks)**

b. A 3ϕ power system consists of a synchronous generator connected to a infinite bus bar through a loss less double circuit transmission line. A fault occurs on the transmission line. The maximum power transfer for the system when unfaulted is 5Pu and immediately prior to the instant of the fault the power transfer is 2.5pu. The power angle curves during fault and post fault conditions have peak values of 2pu and 4pu respectively. Determine the critical clearing angle. **(08 Marks)**

**OR**

10 a. Derive the power angle equation as applied to salient pole synchronous machine. **(07 Marks)**

b. Explain the terms :
   i) steady state stability
   ii) transient stability
   iii) dynamic stability as applied to power system **(03 Marks)**

c. A 50Hz, 4P, turbo generator rated 100MVA, 11KV, has an inertia constant of 8 MJ/MVA.
   i) Find the stored energy in the rotor at synchronous speed
   ii) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50MW, find rotor acceleration not neglecting mechanical and electrical losses.
   iii) If the acceleration calculated in part (ii) is maintained for 10 cycles, find the change in torque angle and rotor speed in revolution per minute at the end of this period. **(06 Marks)**

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15EE63

# Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
## Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions, choosing one full question from each module.***

### Module-1

1 a. Find the 4-point DFT of the sequence, $x(n) = 6 + \sin\frac{2\pi n}{4}$, $0 \le n \le 3$. **(08 Marks)**

b. Given the sequence $x(n) = \cos\frac{\pi n}{2}$ and $h(n) = 2^n$. Compute the 4-point circular convolution. **(08 Marks)**

**OR**

2 a. State and prove the following properties of DFT i) Periodicity and ii) Linearity. **(06 Marks)**

b. Consider a FIR filter with impulse response h(n) = {3, 2, 1, 1} if the input is x(n) = {1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1}. Find the output y(n), use overlap-add method, assuming the length of block is 7. **(10 Marks)**

### Module-2

3 a. Why FFT is needed? What is the speed improvement factor in calculating 04-point DFT of a sequence using direct computation and FFT algorithm? **(06 Marks)**

b. Compute the 8-point IDFT of the sequence $\alpha(k)$ = {0, 2 + 2j, -j4, 2 – 2j, 0, 2 + 2j, j4, 2 – 2j} using the inverse radix-2 DIT algorithm. **(10 Marks)**

**OR**

4 a. What are the differences and similarities between DIT and DIF-FFT algorithm? **(06 Marks)**

b. Using DIF FFT algorithm, compute the sequence x(n) = {1, 2, -1, 2, 4, 2, -1, 2}. **(10 Marks)**

### Module-3

5 a. Transform $H(s) = \frac{s+a}{(s+a)^2 + b^2}$ in to a digital filter using impulse invariance technique. **(08 Marks)**

b. Show that the bilinear transformation maps.

i) The $j\Omega$ axis in s-plane on to the unit circle, $|z| = 1$.

ii) The left half s-plane, $Re(s) < 0$ inside the unit circle, $|z| < 1$. **(08 Marks)**

**OR**

6 a. Mention the difference between Butterworth and Chebyshev filters. **(04 Marks)**

b. Determine the H(z) for a lowest order Butterworth filter satisfying following constraints:

$\sqrt{0.5} \le |H(e^{jw})| \le 1 \qquad 0 \le |w| \le \pi/2$

$|H(e^{jw})| \le 0.2 \qquad 3\pi/4 \le w \le \pi$, with $T = 1\,\text{sec}$. Apply impulse invariant transformation. **(12 Marks)**

## Module-4

7 a. Obtain the cascade realization of system function, $H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-1} + 2z^{-3}$. **(04 Marks)**

b. Design the digital filter using Chehyshev approximation and bilinear transformation to meet the following specifications:

i) Passband ripple = 1dB for $0 \le w \le 0.15\pi$

ii) Stopband attenuation $\ge$ 20dB for $0.45\pi \le w \le \pi$ **(12 Marks)**

**OR**

8 a. Obtain the direct form-I, direct form – II, cascade and parallel form realization for the following system:

$y(u) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. **(12 Marks)**

b. Obtain the direct form-I structure for the given impulse response of a filter:

$h(u) = \left(\frac{1}{2}\right)^n [u(n) - u(n-3)]$. **(04 Marks)**

## Module-5

9 a. The frequency response of a linear phase FIR filter is given by,

$H(e^{jw}) = e^{j3w}[2 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w]$.

Find the impulse sequence of the filter. **(12 Marks)**

b. Mention the advantages and disadvantages of frequency sampling method. **(04 Marks)**

**OR**

10 a. Compare IIR filter and FIR filter. **(08 Marks)**

b. Design an FIR filter (lowpass) using rectangular window with passband gain of 0dB, cut-off frequency of 200Hz, sampling frequency of 1kHz. Assume the length of the impulse response as 7. **(08 Marks)**

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