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10EE61

Sixth Semester B.E. Degree Examination, June/July 2018
Power System Analysis & Stability

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is a per unit system? What are its advantages and disadvantages? **(06 Marks)**

b. Show that the pu impedance of a transformer is same either referred to primary or secondary side of it. **(06 Marks)**

c. The single line diagram of a power system is shown below. Draw its pu impedance diagram:

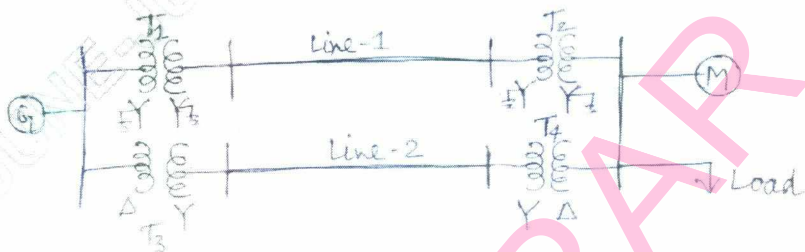

Fig. Q1 (c)

G : 90 MVA, 11 KV, $X'' = 18\%$
T_1 : 70 MVA, 11/110 KV, X = 15%
T_2 : 60 MVA, 110/11 KV, X = 10%
T_3 : Three 1ϕ units each rated 10 MVA, 11/127 KV, X = 9%
T_4 : Three 1ϕ units each rated 16.6667 MVA, 127/11 KV, X = 12%
Line-1 : z = j80 Ω
Line-2 : z = j120Ω
M = 85 MVA, 11 KV, $X'' = 13\%$
The load absorbs 74 MVA, 0.8 pf lagging at 6.5 KV. Select a common base of 100 MVA, 11 KV on the gen side. **(08 Marks)**

2 a. Define a fault that occur in a power system. What are the main causes for it? Also define the symmetrical faults. **(05 Marks)**

b. Briefly explain how a synchronous machine on no-load offers a timely varying reactance, when subjected to a sudden 3ϕ short circuit across its terminals. **(07 Marks)**

c. A transformer rated at 50 MVA and having a SC reactance of 5% is connected to the bus-bar which is supplied through two 66 KV feeder cables (lines) each having an impedance of (1.5+j2.5) Ω. One of the feeders is connected to a generating station rated at 80 MVA and having a SC reactance of 10% and the other feeder is connected to another generating station rated at 100 MVA and having SC reactance of 15%. Determine the MVA at the fault point in the event of a SC between the secondary terminals of the transformer. Choose base MVA as 400 and base KV as 66 on the generator side. The single line diagram of power system is shown in Fig. Q2 (c). **(08 Marks)**

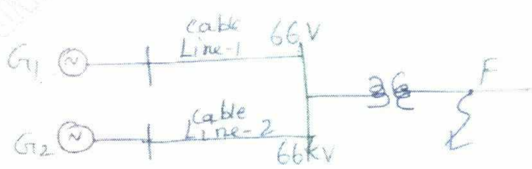

Fig. Q2 (c)

3 a. Explain the three sets of symmetrical components with their phasor diagram. **(04 Marks)**

b. Define the complex operator 'α' and state its properties. **(04 Marks)**

c. A delta connected balanced resistive load is connected across an unbalanced three phase supply as shown below. Find the symmetrical components of line currents and delta currents. **(12 Marks)**

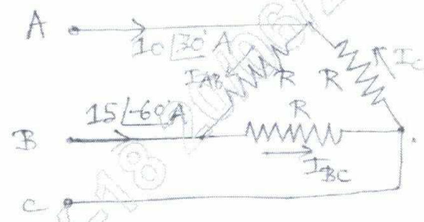

Fig. Q3 (c)

4 a. Draw the three sequence networks of an unloaded synchronous machine and transmission lines. **(05 Marks)**

b. A single line diagram of the power system is shown below. The positive, negative and zero sequence reactances of the components are given below along with their ratings. Draw the positive, negative and zero sequence networks of this power system on the base of generator ratings.

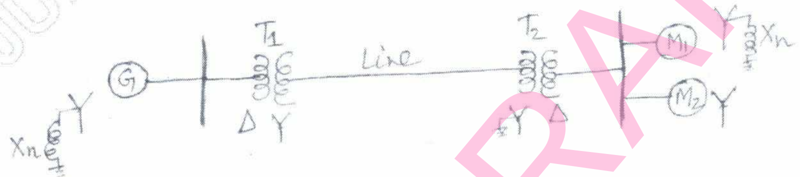

Fig. Q4 (b)

G : 30 MVA, 13.8 KV, $X'' = 0.15$ pu, $X_2 = 0.15$ pu and $X_n = 2\ \Omega$, $X_0 = 0.05$ pu

M_1 : 20 MVA, 12.5 KV, $X'' = 0.2$ pu, $X_2 = 0.15$ pu and $X_n = 2\ \Omega$, $X_0 = 0.05$ pu

M_2 : 10 MVA, 12.5 KV, $X'' = 0.2$ pu, $X_2 = 0.15$ pu and $X_0 = 0.05$ pu

T_1 : 35 MVA, 13.2/115 KV, $X = 0.1$ pu

T_2 : Three 1ϕ units each rated 10 MVA, 12.5/67 KV, $X = 0.1$ pu

Line : $X_1 = X_2 = 80\ \Omega$ and $X_0 = 250\ \Omega$ **(15 Marks)**

PART – B

5 A 25 MVA, 11 KV, 3ϕ generator has a sub transient reactance of 20%. The generator supplies two motors over a transmission line with transformers at both ends. The motors have rated inputs of 15 and 7.5 MVA, both at 10 KV with the subtransient reactance of 25%. The three phase transformers are both rated 30 MVA, 10.8/121 KV with a leakage reactance of 10% each. The series reactance of the line is 100 Ω. Assume that the negative sequence reactance of each machine is equal to its subtransient reactance. Also, assume the zero sequence reactances for the generator and motors as 0.06 pu on its own ratings. The current limiting reactors of 2.5 Ω each are connected in the neutral of the generator and motor. The zero sequence reactance of the line is 300 Ω. Select a base of 25 MVA and 11 KV in the generator circuit, then draw the positive, negative and zero sequence networks of the system. If a solid LG fault occurs at the point F as shown below, calculate the fault current at the fault point. Neglect the prefault current. **(20 Marks)**

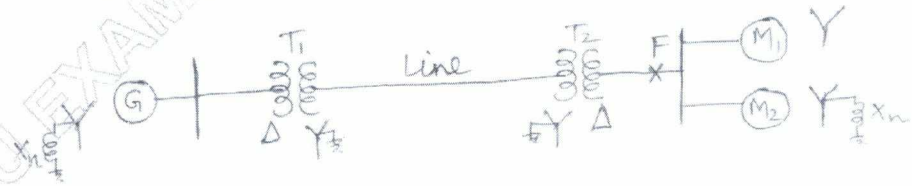

Fig. Q5

6 a. Define an unsymmetrical fault that occur in the power system. What are its various types? **(04 Marks)**

b. Write short notes on open conductor faults in a power system. **(06 Marks)**

c. Derive an equation for fault current, if a double line to ground fault occurs with a fault impedance 'Z_f' on an unloaded synchronous generator, whose neutral is grounded through an impedance Z_n. The generator has balanced emfs and sequence impedances Z_1, Z_2 and Z_0. **(10 Marks)**

7 a. Derive a swing equation of a synchronous generator connected to an infinite bus, with usual notations. **(06 Marks)**

b. Define steady state and transient stability limits. What are the ways to improve them? **(07 Marks)**

c. A 50 Hz, four pole turbo generator rated 100 MVA, 11 KV has an inertia constant of 8.0 MJ/MVA.

(i) Find the stored energy in the rotor at synchronous.

(ii) If the mechanical input is suddenly raised speed to 80 MW for an electrical load of 50 MW, find the rotor acceleration neglecting mechanical and electrical losses.

(iii) If the above mentioned acceleration is maintained for 10 cycles, find the change in torque angle and rotor speed at the end of this period. **(07 Marks)**

8 a. What is equal area criterion? Explain the equal area criterion of stability when there is a sudden loss of one of the parallel lines shown below. **(10 Marks)**

Fig. Q8 (a)

b. Explain in detail, the measurement of negative and zero sequence impedances of synchronous machines. **(10 Marks)**

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10EE63

Sixth Semester B.E. Degree Examination, June/July 2018

Electrical Machine Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Mention the desirable properties of electrical insulating materials. Also give the classification of insulation materials based on temperature with an example for each. **(10 Marks)**

b. Define specific electrical and magnetic loadings for DC machines. Derive the output equation of DC machine both as motor and generator. **(10 Marks)**

2 a. Explain factors that influence the choice of number of poles in case of a d.c. machine. **(10 Marks)**

b. A shunt field coil has to develop an mmf of 9000 A. The voltage drop in the coil is 40V, and the resistivity of round wire used is 0.021 Ω/m and mm^2. The depth of winding is 35 mm approximate and the length of mean turn is 1.4 m. Design a coil so that the power dissipated is 700 W/m^2 of the total coil surface (i.e., outer, inner, top and bottom). Take the diameter of the insulated wire 0.2 mm greater than that of bare wire. **(10 Marks)**

3 a. Derive the output equation of a 3-phase core type transformer. **(10 Marks)**

b. Calculate approximate overall dimensions for a 200 kVA, 6600/440V, 50Hz, 3-ϕ core type transformer. The following data may be assumed :
emf/turn = 10 V ; maximum flux density = 1.3 Wb/m^2 ; current density = $2.5 A/mm^2$.
Window space factor = 0.3 ; overall height = overall width ; stacking factor = 0.9.
Use a 3-stepped core ; Width of largest stamping = 0.9 d and net iron area = 0.6 d^2, where 'd' is the diameter of circumscribing circle. **(10 Marks)**

4 a. Derive an expression for leakage reactance of a transformer with primary and secondary cylindrical coils of equal length, stating clearly the assumptions made. **(10 Marks)**

b. A 1000 kVA, 6600/440 V, 50 Hz, 3-ϕ Δ/Y, core type, oil immersed, natural cooled (ON) transformer. The design data of the transformer is Distance between centres of adjacent limbs = 0.47m, outer diameter of high voltage winding = 0.44 m, height of frame = 1.24 m, core loss = 3.7 kW and I^2R loss = 10.5 kW. Design a suitable tank for the transformer. The average temperature rise of oil should not exceed 35°C.

The specific heat dissipation from the tank walls is 6 W/m^2 °C and 6.5 W/m^2 °C due to radiation and convection respectively. Assume that the convection is improved by 35% due to provision of tubes. **(10 Marks)**

PART – B

5 a. Explain the factors to be considered while selecting length of airgap in an induction motor. **(10 Marks)**

b. Determine the main dimensions, number of radial ventilating ducts, number of stator slots and the number of turns per phase of a 3.7 kW, 400 V, 3 phase, 4 pole, 50 Hz, squirrel cage induction motor to be started by a star delta starter. Assume : Average flux density in the airgap = 0.45 Wb/m^2, ampere conductors per metre = 23000, efficiency = 0.85 and power factor = 0.84. Ratio of length to pole pitch = 1.5. **(10 Marks)**

6 a. A 90 kW, 500 V, 50 Hz, 3-ϕ, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors/slot. If the slipring voltage on open circuit is to be about 400 V, find a suitable rotor winding, stating (i) Number of slots, (ii) Number of conductors/slots, (iii) Coil span, (iv) Slipring voltage on open circuit (v) Approximate full load current/phase in rotor. Assume efficiency = 0.9, p.f. = 0.86. **(10 Marks)**

b. Find the magnetizing current, no load current, no load power factor of a 15 HP, 440 V, 6 pole, delta connected slip ring induction motor having the following data : Number of stator slots = 54, conductors/slot = 28, flux/pole = 8.25 MWb, gap area/pole = 183.5 cm^2, gap length = 0.55 mm, iron losses = 510 W, friction and windage losses = 110 W, gap expansion coefficient = 1.33. Iron parts of magnetic circuit requires 20% of ATS required for the gap kw_1 = 0.96. **(10 Marks)**

7 a. Define short circuit ratio and explain the effects on the design of an alternator. **(10 Marks)**

b. Determine a suitable number of slots and conductors per slot for the stator winding of a 3-phase, 3300 V, 50 Hz, 300 rpm alternator. The diameter is 2.3 m and the axial length of core is 0.35 m. The maximum flux density in the airgap should be approximately 0.9 Wb/m^2. Assume sinusoidal flux distribution. Use single layer winding and star connection for stator. **(10 Marks)**

8 Write short notes on any four :

a. Factors to be considered in selection of number of slots in synchronous machines
b. Cooling of transformer
c. Cogging and crawling of induction motor
d. Magnetic materials used in electrical machines
e. Design procedure for designing of field winding of a salient pole alternator. **(20 Marks)**

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10EE64

Sixth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Find the N-point DFT of sequence $x(n) = a^n,\ 0 \le n \le N-1$. **(06 Marks)**
b. State and prove circular convolution property. **(06 Marks)**
c. Determine the DFT of the sequence $x(n) = n^2,\ 0 \le n \le 7$. **(08 Marks)**

2 a. A discrete time LTI system has impulse response $h(n) = 2\delta(n) - \delta(n-1) + 2\delta(n-2)$. Determine the output of the system if the input is $x(n) = 4\delta(n) - 4\delta(n-1) + 8\delta(n-2) - 8\delta(n-3)$; using circular convolution. **(04 Marks)**
b. Using overlap and save method, determine output y(n) of a filter whose impulse response is $h(n) = \{1, 2, 3\}$ and input $x(n) = \{1, -1, 2, -2, 3, -3, 4, -4\}$. Use 6 point circular convolution. **(10 Marks)**
c. Consider the sequence $x(n) = 2\delta(n) + 3\delta(n-1) + 4\delta(n-2) + 5\delta(n-3)$. Compute 6 point DFT of the sequence x(n). Also determine the finite length sequence y(n), that has 6 point DFT $Y(K) = W_6^{4k} X(K)$. **(06 Marks)**

3 a. Determine the 8-point DFT of sequence $x(n) = 2(n+1)$, using DIF-FFT algorithm. Also plot magnitude and phase spectra. **(12 Marks)**
b. Develop DITFFT algorithm for decomposing the DFT for N = 9 with flow diagrams. **(08 Marks)**

4 a. Determine IDFT using DIT-FFT for given frequency samples $x(k) = \{0, 2-j4.828, 0, 2-j0.828, 0, 2+j0.828, 0, 2+j4.828\}$ **(10 Marks)**
b. Explain in-place computation technique in FFT algorithm. **(05 Marks)**
c. Calculate the number of multiplications and additions required in DFT and FFT, with 32 point sequence. Also find the speed improvement factor and number of stages. **(05 Marks)**

PART – B

5 a. Compare IIR & FIR filters. **(04 Marks)**
b. Explain the transformation of an analog normalized lowpass filter into analog lowpass, high pass filter using frequency transformation methods. **(06 Marks)**
c. A digital lowpass filter is required to meet the following specifications:
(i) Monotonic passband and stopband.
(ii) – 3.01 dB cutoff frequency of 0.5π rad.
(iii) Stopband attenuation of atleast 15 dB at 0.75π rad.
Find the system function H(z) and the difference equation realization. **(10 Marks)**

6 a. Derive the bilinear transformation for transforming an analog filter to a digital filter. **(10 Marks)**

b. Design a Butterworth analog highpass filter that will meet the following specifications.
(i) maximum passband attenuation = 4 dB
(ii) passband edge frequency = 400 rad/sec
(iii) minimum stopband attenuation = 40 dB
(iv) stopband edge frequency = 200 rad/sec. **(10 Marks)**

7 a. Design a Chebyshev I filter to meet the following specifications:
(i) Passband ripple : ≤ 2 dB
(ii) Passband edge 1 rad/sec
(iii) Stopband attenuation ≥ 20 dB
(iv) Stopband edge 1.3 rad/sec **(10 Marks)**

b. Determine the Butterworth polynomial of the order N = 5. **(10 Marks)**

8 a. Obtain cascade realization for a system having the following system function :

$$H(z) = \frac{(z-1)(z-2)(z+1)z}{\left(z-\frac{1}{2}-j\frac{1}{2}\right)\left(z-\frac{1}{2}+j\frac{1}{2}\right)\left(z-j\frac{1}{4}\right)\left(z+j\frac{1}{4}\right)}$$ **(05 Marks)**

b. Obtain parallel realization for the given system

$$H(z) = \frac{\left(1+z^{-1}\right)\left(1+2z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)\left(1+\frac{1}{8}z^{-1}\right)}$$ **(05 Marks)**

c. Realize an FIR linear phase filter for N even, and hence realize the following system filter :

$$h(n) = \delta(n) + \frac{1}{16}\delta(n-1) - \frac{1}{32}\delta(n-2) + \frac{1}{16}\delta(n-3) + \delta(n-4).$$ **(10 Marks)**

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Sixth Semester B.E. Degree Examination, June/July 2018
Electrical Engineering Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With neat sketches, explain Fermi Dirac Distribution at different temperatures. **(08 Marks)**
b. With usual notations prove that $R_T = R_t [1 + \alpha_t (T - t)]$ **(08 Marks)**
c. A copper wire and an aluminium wire have same length and resistance. If same current passes through a copper and aluminium wires have same length and resistance, which wire will have higher temperature rise? Give justification. **(04 Marks)**

2 a. Draw a typical hysteresis loop for a ferromagnetic materials and explain. Show the residual magnetism and coercive force on a loop and define them. **(10 Marks)**
b. Define Hall effect. With neat sketch, explain the concept of hall effect and arrive at an equation for Hall voltage V_H. **(10 Marks)**

3 a. Write short note on the following: i) Dipolar relaxation ii) Dielectric loss. **(10 Marks)**
b. List the characteristics of good insulating material and Dielectric material. **(06 Marks)**
c. List out the properties of SF_6 gas. **(04 Marks)**

4 a. Explain the procedure for testing the dielectric strength of transformer oil with neat sketch. **(08 Marks)**
b. What is Polarization? Explain the different types of polarization **(08 Marks)**
c. Write a note on Dielectric loss. **(04 Marks)**

PART – B

5 a. Explain the working of solar photo – voltaic cell with a neat sketch. Also draw the equivalent circuit and VI characteristics of Solar PV cell. **(10 Marks)**
b. With a neat sketch explain the basic working principle of fuel cells. **(05 Marks)**
c. Write short note on Cold Mirror coating. **(05 Marks)**

6 a. With a neat sketch. Explain Electron Microscopy. **(10 Marks)**
b. Explain the concept of NMR with the help of NMR spectro-meter. **(10 Marks)**

7 a. What is piezo- electricity? Explain the construction and working of piezo-electric device. **(08 Marks)**
b. Define Magnetostriction. Explain different types of magnetostriction with the help of necessary graphs with applications. **(10 Marks)**
c. Define Ferromagnetic curie temperature. **(02 Marks)**

8 a. What are the general properties of ceramics and how it is applicable to capacitor? **(08 Marks)**
b. Write short note on Rubber. **(05 Marks)**
c. Explain the Thermoplastic and Thermosetting materials and give example for each. **(07 Marks)**

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