رابعة قوى (قديم)
مقرر: اتصالات كهربية

Tanta University
Faculty of Engineering
Time : 3 Hours.

4th Year (old sy.) Power. Eng
Electrical Communications
Jan. 2008.

Answer the following Questions:

1. **(a)** List several sources of external noise and internal noise and give a brief description of each.

   (b) For an electronic device operating at a temperature of 17 °C with a bandwidth of 10 kHz, determine :
   (i) Thermal noise power in watts and dBm
   (ii) rms noise voltage for a 100 Ω internal resistance and a 100 Ω load resistance ($K = 1.38 \times 10^{-23}$ Jouls / K)

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2. **(a)** Sketch the block diagram of integrated circuit waveform generator and explain its operation

   (b) Sketch the block diagram of a PLL and describe how loop acquisition is accomplished with a PLL from an initial unlocked condition until frequency lock is achieved
   (c) Determine the hold- in range for a PLL with an open loop gain of K_L =20 kHz / rad

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3. **(a)** Sketch the block diagram of a multiple crystal frequency synthesis and explain its operation.
   (b) Describe the relationship between the carrier and sideband powers in an AM DSBFC wave. .

   (c) For an AM DSBFC modulator with carrier frequency f_c = 100 kHz and a maximum modulating signal $f_{m(max)}$ = 5 kHz , determine
   (i) Frequency limits for the upper and lower sidebands.
   (ii) Bandwidth
   (iii) Upper and lower side frequencies produced when the modulating signal is a single frequency 3 kHz.

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4. **(a)** Sketch the block diagram of a high level AM DSBFC transmitter and explain its operation.

   (b) For a receiver with IF ,RF, and local oscillator frequencies of 455 kHz,1100 kHz, and 1555 kHz, respectively ,determine
   (i) Image frequency
   (ii) Image frequency rejection ratio for a preselector Q = 100

   (c) Determine the net receiver gain for an AM receiver with the following gains and losses: RF amplifier = 30 dB , IF amplifier = 44 dB, Audio amplifier = 24 dB , preselector loss = 2 dB, mixer loss = 6 dB , detector loss = 8dB

Good Luck

(٤ قوى (حديث

Tanta University **Faculty of Engineering** **First Semester Examination** **Academic Year: 2008-2009** **Time Allowed: 3 hours**	**Department: Elect. Power & Mach.** **Year:** 4th **Subject/Code: Dynamic Analysis of Elect. Mach.** {(3) مقرر اختيارى} **Date:** 29/1/2009

Allowed Tables and Charts: ***(None)***

Answer all the following Questions **[70 Marks]**

Question (1)

Explain how the principles of field orientation can be applied to the ac rotating machine. Give example for the performance of three phase induction motors when controlled using field oriented control technique.

Question (2)

(a) Write neatly the equations that represents the mathematical model of a three phase induction motor in an arbitrary frame. Then, Deduce Park's transformation relating the three-phase currents of AC rotating machines to its corresponding d-q axis currents. Express three-phase currents in terms of d-q axes and its inverse.

(b) Deduce the principles of fuzzy logic controller.

Question (3)

For a separately excited DC motor with armature resistance and inductance R and L respectively, and has moment of inertia of J and negligible friction:

- *Write the equations that describe the behavior of the motor and then find the transfer function* $\omega(s)/v(s)$
- *Prove that by using integral controller the steady state error for step load torque will be zero*
- *Give example for the performance of DC motors when controlled using PI controller.*
- *What are the advantages and disadvantages of proportional and derivative controller*
- *What is the advantages of using Fuzzy logic controller over the classical PID controller*

Question (4)

Use the three-phase induction motor to explain the principle of direct torque control. Deduce the motor dynamic model and show how the application of this method of control would affect the motor performance.

With the best wishes

Prof. Dr. Elwy El-kholy

رابعة قوى - حديث - تطبيقات الحاسب في نظم القوى

Tanta university Faculty of engineering Electrical Power and Machine Dept. Computer Applications in Electric Power System	Final Term Exam 4-th Year 2008-2009 Allowable Time: 3 H

Solve The Following Questions

Question 1 (25 Marks)

a) **Prove that** the relations that used to insert new branch between old bus (p) and new bus (q) in impedance bus matrix calculations can be evaluated from:

$$Z_{iq} = Z_{ip}, \quad i = 1,2,\ldots,n$$

$$Z_{qq} = Z_{pq} + z_{pq}$$

b) **Prove that** the relation that used to insert new branch between bus (q) and reference bus, earth, in impedance bus matrix calculations can be evaluated from:

$$Z_{qq} = z_{q0}, \quad q = 1,2,\ldots,n$$

c) For system shown, (i) **find** bus impedance matrix; (ii) **find** rating of CB_1 and CB_3, if bus voltages is 1 p.u.; (iii) if solidly three-phase fault occurred at bus 1, **find** bus voltages during fault and current between buses.

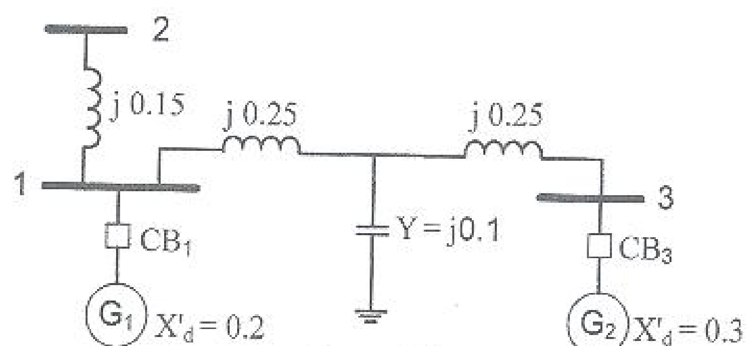

Figure (1)

Question 2 (25 Marks)

a) **Write down** an algorithm of fast-decoupled method.

b) **Write** a MATLAB program to evaluate Jacobian matrix in Newton Raphson method.

c) **Write** a MATLAB program to evaluate power flow through lines, active and reactive power generation at slack bus and reactive power generation at voltage control bus.

d) **Compare** between Newton-Raphson and Fast decoupled methods.

Question 3 (**25 Marks**)

a) The voltage at bus 1 is adjusted at $V_1 = 1.04\angle 0^0$ $p.u.$, for system shown in Figure (2). Using Gauss-Seidel method, start with initial estimates of $V_2^0 = 1\angle 0^0$ $p.u.$ and $V_3^0 = 1.05\angle 0^0$ $p.u.$, **Calculate** the bus voltage at buses 2 and 3 (only 1 iteration required).

b) If after several iteration $V_2 = 1.0161\angle -2.6723^0$ $p.u.$ and $V_3 = 1.05\angle -1.2864^0$ $p.u.$, **find** the active and reactive power losses through line between bus 1 and 2, active and reactive power generation at slack bus and reactive power generation at voltage control bus.

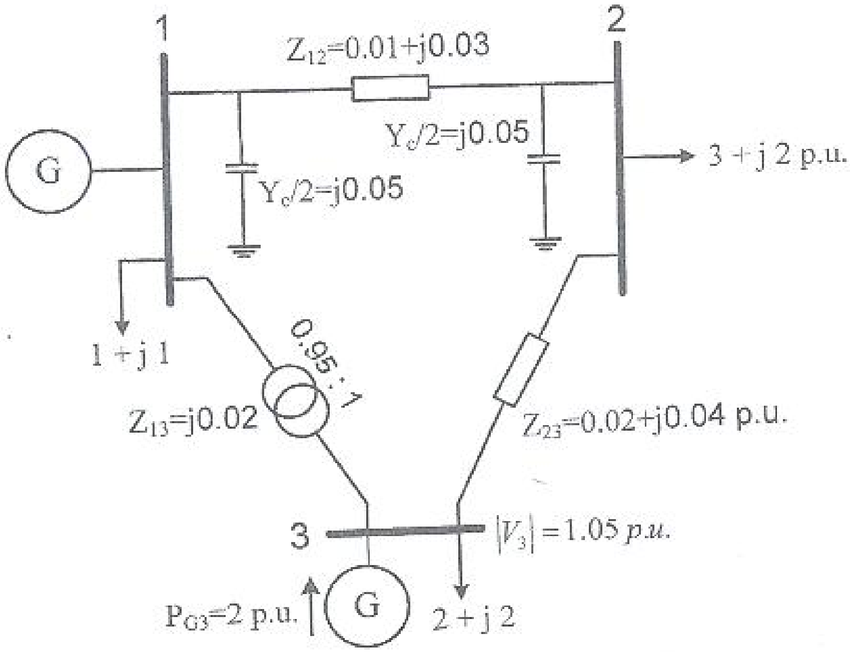

Figure (2)

(With My Best Wishes)

Dr. Ibrahim Bedir

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ع قوى (حديث) الآلات الكهربية ٤

Tanta university	**Faculty of Engineering**
Department: Electrical Power and Machines	**4th Electrical Power**
Academic Year: (2008/2009)	**First Term Exam. (January 22 , 2009)**
Time Allowed: 3 Hrs.	**Course Title: Electrical Machines (4)**
No. of Pages:2	**Marks: (120)**

Try To Answer <u>ALL</u> Questions

[1] **(a)** Why short-pitch winding is preferred over full pitch winding? Define winding factor. **(5 Marks)**

(b) The flux density distribution curve in the air gap of a 50-Hz, 3-phase synchronous generator is:

$$B(\theta) = 1.15\sin\theta + 0.25\sin 3\theta - 0.2\sin 5\theta - 0.15\sin 7\theta \ \ \text{wb/m}^2$$

Where θ is measured from the natural axis. The pole-pitch is 40 cm and core length is 34 cm. The machine has 12 slots per pole each containing 6 conductors. The winding is double-layer, with a phase spread of 60 degrees, and each coil spans 120 degrees. If the generator is driven at a speed of 750 rpm, **determine** the equation of the emf induced in each phase and its effective value. **(10 Marks)**

[2] **(a)** From the phasor diagram of a salient-pole synchronous generator working at a leading pf, but with pf angle φ less than load angle δ, obtain the following relations:

i. $$\tan(\delta - \varphi) = \frac{I_a X_q - V\sin\varphi}{V\cos\varphi + I_a R_a}$$

ii. $$E_f = V\cos\delta + I_q R_a + I_d X_d$$

(10 Marks)

(b) Find the excitation voltage of an alternator when delivering rated output at 0.8 pf leading and at rated voltage, if. X_d = 1.25 pu and X_q = 1.0 pu. **(5 Marks)**

[3] **(a)** What is meant by load angle of an alternator? **(5 Marks)**

(b) A 3-phase, 350-KVA, 3300-V, 60-Hz, 6-pole, Y-connected synchronous machine, with a cylindrical rotor type and all losses can be neglected. Its synchronous reactance is 10.0 Ω /phase.

i. When the machine operates as a generator delivering full-load at rated voltage and with a lagging power factor of 0.9, construct the circle diagram and hence determine the excitation voltage and the load angle.
ii. Compute the current and power when the machine is operating as a motor at 0.6 power-factor leading.
iii. With the excitation voltage adjusted to the same value as the terminal voltage, find the power factor when the machine is running as a generator delivering 80 A at rated voltage.

(15 Marks)

[4] **(a)** Define the term voltage regulation of alternator. **(5 Marks)**

(b) The following data are obtained from the open-circuit characteristics of a three-phase, Y-connected, 4-pole, 150-MVA, 0.85pf, 12.6-kV, 60-Hz, synchronous generator with negligible armature resistance.

Open-circuit characteristic:

Field current, A	200	300	400	500	600	700	800	900
Terminal voltage, KV	3.8	5.8	7.8	9.8	11.3	12.6	13.5	14.2

	Short-circuit characteristic: Armature current, A: 4043, 8086 Field current, A: 350, 700 **Determine:** i. The unsaturated synchronous; ii. The saturated synchronous reactance at rated voltage; iii. The short-circuit ratio; and iv. The voltage regulation at full-load and 0.85 power-factor leading. **(15 Marks)**
[5]	**(a)** What is synchronizing? What conditions must be fulfilled before an alternator can be connected to an infinite bus? **(5 Marks)** **(b)** Two similar alternators operating in parallel have the following data: **Aternator I:** rated power 700 kW, frequency drops from 50 Hz at no-load to 48.5 Hz at full-load. **Alternator II:** rated power 700 kW, frequency drops from 50.5 Hz at no-load to 48 Hz at full load. Speed regulation of prime-movers is linear in each case. **Calculate:** i. How a total load of 1200 kW is shared by each alternator?. Also find the operating bus-bar frequency at this load. ii. The maximum load that these two units can deliver without overloading either of them. **(15 Marks)**
[6]	A 300 kW, 6600 V, 8-pole, 50 Hz, 3-phase, Y-connected, non-salient pole synchronous motor has the following parameters at base speed; $X_s = 72\Omega / phase$ at 50 Hz, R = 0 $\Omega / phase$, and $E_f = 320$ V/phase. For operation at base speed, **calculate:** i. The load angle of the motor when it delivers rated load; ii. The motor input current and power factor of the drive for this condition of operation; and iii. The maximum power and torque the motor is capable of developing while running at base speed. **(15 Marks)**
[7]	The following is the design data available for a 1250 KVA , 3- phase, 50 Hz, 3300 V, 6-connected, 300 rpm alternator of salient pole type : D = 1.9 m , L = 0.335 m , pole arc / pole pitch = 0.66 Turns per phase = 150 , single layer concentric winding with 5 conductors per slot , short circuit ratio = 1.2 . Assume that the distribution of gap flux is rectangular under the pole arc with zero values in the inter polar region. Mmf required for air gap is 80 % of no load field mmf and the gap contraction factor is 1.15 . **Calculate:** (a) Specific magnetic loading, (b) Armature mmf per pole, (c) Air gap flux density over pole arc, (d) Air gap length. **(15 Marks)**

Good Luck **Professor Ali M. Osheiba**

ع قوى هديه

Tanta University	Fourth Year
Faculty of Engineering	Final-Term Examination 2008-2009
Electrical Power and Machines Engineering Dep.	Power System Protection
Student name: --	Allowable Time: 3 hours

Answer the following questions:

First Question:

1-a What is protective relaying? Explain the various functions of protective relaying? (3 points)

1-b Why the protective zones are arranged in overlap fashion? With the help of simple diagram, show how the zones are overlapped. (3 points)

1-c Discuss the basic action of a backup protection. (3 points)

1-d Describe the construction and working of a Buchholz relay and its use. (4 points)

1-e In the part of the network shown in Fig. 1, the minimum and maximum operating times for each relay are 0.6 and 2.0 cycles, and each circuit breaker has the minimum and maximum operating time of 2.0 and 5.0 cycles. Assume that a safety margin of 3.0 cycles between any primary protection and backup protection is desirable. P_2 is the local backup for P_1, and P_3 is the remote backup. Draw a timing diagram to indicate the various times at which the associated relays and breakers must operate to provide a coordinated backup coverage for fault F. (5 points)

Fig. 1

Second Question:

2-a Explain the following terms related to protective relays:

i) Pickup ii) Dropout or Reset iii) Time delay iv) Trip circuit

(4 points)

2-b How are relay time, breaker time and fault clearing time related? (4 points)

2-c Describe with neat sketch the operation of solenoid and plunger type relay. (4 points)

2-d Consider the transmission line connected to a generator as shown in Fig. 2. The impedance data for the generator and the line are given in the Figure. A relay located at terminal A detects all faults on the transmission line. Assume a pre-fault voltage of 1.0 pu, and allow for a possible steady-state overvoltage of 1.2 pu during normal operation. Determine the pickup settings for an overcurrent relay used as fault detectors for this circuit. Allow a sufficient margin between the normal conditions and the pickup settings to accommodate any inaccuracies in relay performance.

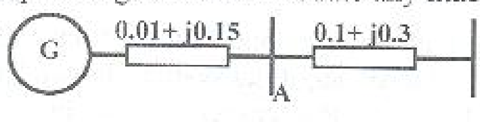

Fig. 2 (6 points)

Third Question:

3-a If the fault current consists of AC and DC components, what is the percentage overreach of a practical instantaneous overcurrent relay in terms of relay operating time and power system constants? (5 points)

3-b Define the terms 'Plug Setting' and 'Time Setting' as used in the context of an IDMT relay. (5 points)

3-c Choose time settings for the normal IDMT relays at R_1 and R_2 shown in Fig. 3.

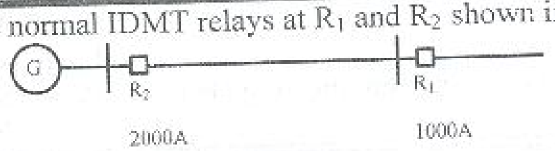

Fig. 3.

Phase fault currents are shown.
Load current, through R_2 = 200A, and through R_1 = 75A.
CT ratio at R_2 = 200/5 and at R_1 = 100/5. Plug setting are in steps of 25% to 200%.
The time-current characteristic of the relay is given in the following table: (8 points)

Plug Setting Multiplier	2	3	5	10	15	20
Time for TS of 1 (sec)	10	6	4.1	3	2.5	2.2

Fourth Question:

4-a What are the main features of directional relays? And where are these relays used? (5 points)

4-b Describe the principle of a directional overcurrent relay. How does it help in discrimination in protection of parallel feeders? (5 points)

4-c Simple time graded overcurrent relays are applied to a 5 bus ring main (single feed point). Circuit breakers are connected at each side of each bus. Choose time delays for each ovecurrent relay and indicate which relays need to be directional. (8 points)

Fifth Question:

5-a Explain what is meant by distance protection. What arrangement is made to make the relay measure positive sequence impedance only for L-L and 3-phase fault? (6 points)

5-b Explain why first zone of distance relay cover only 80% of the protected line section. How can the remainder part of line protected. (6 points)

5-c Consider the multi-terminal line in the system shown in Fig. 4. Each of the buses C, D, G, H and J has a source of power behind it. For a three-phase fault on bus B, the contributions from each of the sources are as follows:

Source	Current
[illegible]	600
C	200
D	300
G	800
H	400

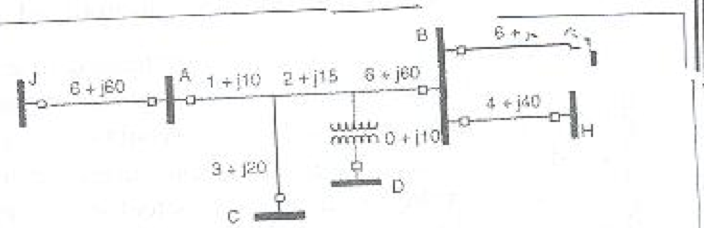

Fig. 4

You may assume that the fault current contributions from each of these sources remain unchanged as the fault is moved around throughout the system shown. Determine the zones 1, 2 and 3 settings for the distance relay at bus A. Remember to take into account the effect of the infeed for determining the zones 2 and 3 settings, while no infeeds are to be considered for the zone 1 settings. (6 points)

Good Luck

Dr. Mohammed Abo-Elazm Alaam, et al