Tanta University

Department: Elec. Power and Machines Engineering
Total Marks (electric part): 70 Marks

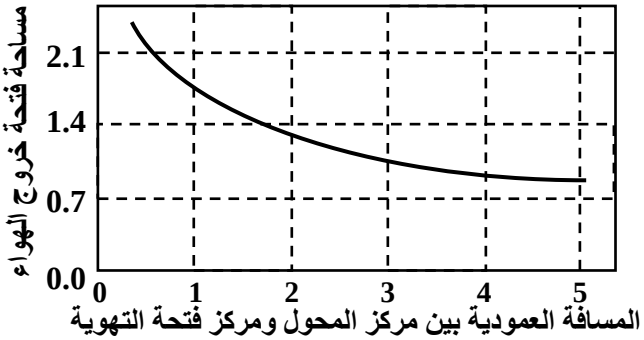
Faculty of Engineering

Course Title: Electrical Installations	Course Code: EPM4121	Year: forth year
Date: January 2010 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Problem number (1) (15 Marks)

أ - وضح أسباب اختلاف المقاومة للتيار المستمر عن المقاومة للتيار المتردد في الكابلات مع ذكر العوامل التي تتوقف عليها هذه الأسباب (5 درجات)

ب - صمم حجرة خاصة لمحول 1600 ك.ف.أ. وحدد أبعاد فتحة التهوية بدون شبك علما بأن المحول سيوضع علي عوارض حديدية بارتفاع 70 سم. استخدم الجدول و المنحني المرفقين. (5 درجات)



قدرة المحول ك.ف.أ.	الطول (سم)	العرض (سم)	الارتفاع (سم)	ارتفاع جسم المحول (سم)
630	185	102	195	100
1600	220	140	280	160
2000	240	155	300	170
3000	260	170	325	180

ت - يراد حماية كابل ألمنيوم بطول 260م ومساحة مقطع 70 مم^2 باستخدام نبضية حماية مزودة بإعتاق مغناطيسي. فإذا كانت فولطية التشغيل تساوي 480 فولت ومساحة مقطع الحيادي تساوي نصف مساحة مقطع الوجه وقيمة الأعتاق المغناطيسي 1300 أمبير ويوجد 3 كوابل متساوية المقطع ومتصلة بالتوازي، بين ما إذا كان يمكن حماية الكابل عند جميع ظروف التشغيل. استخدم معاملات التصحيح من الجداول المرفقة. (5 درجات)

V	220	400	415	440	480	500	660
K_1	0.58	1.05	1.11	1.16	1.26	1.31	1.73

عدد الكوابل	2	3	4	5	6
K_2	2	2.65	3	3.2	3.33

Problem number (2) (15 Marks)

أ - أذكر أهم الاعتبارات التي يجب مراعاتها عند تنفيذ الإضاءة في الأماكن التالية: (5 درجات)
المكاتب الخاصة 2- المستشفيات 3- القاعات الدراسية

ب - بين إمكانية تغذية محرك أحادي 500 فولت بكابل نحاسي طوله 100م ومساحة مقطعه 35 مم2 عند تيار تشغيل عادي 80 أمبير بمعامل قدرة 0.8 وتيار بدأ إقلاع 450 أمبير بمعامل قدرة 35%. أقصى فقد للفولطية مسموح به على أطراف المحرك 8%. فقد الفولطية في الكابل الرئيسي المغذي للوحة المحرك عند تيار التشغيل العادي = 6 فولت وتيار الكابل الرئيسي 600 أمبير. يمكنك استخدام جدول فقد الفولطية المرفق (فقد الفولطية بين الأطوار بالفولت/أمبير/كم للمحركات). (5 درجات)

مقطعه الكابل مم2		دارة محركات أحادية الطور		دارة محركات ثلاثية الطور	
نحاس	ألومونيوم	تشغيل عادي Cos ϕ = 0.8	بدأ الإقلاع Cos ϕ = 0.35	تشغيل عادي Cos ϕ = 0.8	بدأ الإقلاع Cos ϕ = 0.35
25	35	1.5	0.75	1.3	0.65
35	50	1.15	0.6	1	0.52
50	70	0.86	0.47	0.75	0.41
70	120	0.64	0.37	0.56	0.32

ت - بين أهمية التأريض للأجسام المعدنية المكشوفة ووضح تأثيره علي جهد الجسم المعدني المكشوف عند حدوث قصر (5 درجات)

P.T.O.

Good Luck

Course Examination Committee

Dr. Ahmed Refaat
Dr. Saeed Allam
Dr. Mohamed Abo El Azm
Prof. Mohamed Tantawy

Course Coordinator: Dr. Ahmed Refaat

قوى حديد الاداء الديناميكى للآلات

Tanta University

Department: Elec. Power and Machines Engineering
Total Marks: 70 Marks

Faculty of Engineering

Course Title: Electrical Machines Dynamics	Course Code: EPM4124	Year: 4th
Date: Feb. 3rd 2010 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches if possible)

Question number (1) **(22 Marks)**

a) **Derive** a mathematical model by which the dynamic behaviour of a series dc motor can be predicted. **Show** how this model is transformed using Laplace transformation technique, then **write down** the model in the matrix form: $[U_{input}] = [A][X_{output}]$. (7 Marks)

b) **Derive** a mathematical model by which the dynamic behaviour of a separately excited dc generator can be predicted under a constant speed operation. **Setup** the differential equations in the matrix form: $[\dot{X}] = [A][X] + [B][U]$. (5 Marks)

c) Consider a separately excited dc generator with the following data: $R_a = 0.15\ \Omega$, $L_a = 5$ mH, $R_f = 3\ \Omega$, $L_f = 0.5$ H. Rated voltage = 220 V, rated armature current = 80 A and rated field current = 5 A. **If** the generator operates at a constant speed of 1500 rpm under rated conditions, **answer** the following:

(i) **Determine** the transfer function of the generator voltage.
(ii) **Determine** the voltage and the current variations as functions of time after a step increase of 10 percent in the field winding voltage.
(iii) **Simplify**, giving a suitable reason(s), the obtained voltage and current functions.
(iv) **Determine** the short circuit current as a function of time in the case of a sudden short circuit occurs across the armature at constant field current. (10 Marks)

Question number (2) **(28 Marks)**

a) **Derive** a detailed mathematical model by which the dynamic behaviour of a three-phase induction motor can be predicted in its natural abc-axis variables, then **answer** the following:

(i) **Write down,** aiding with appropriate drawing(s), the transformation matrices required to transform the abc-axis model to an arbitrary reference frame qdo-axis model.
(ii) **Derive** an expression of the transformed qd-axis supply voltages as a function of time in stationary, rotor and synchronous reference frames.
(iii) **Write down** a complete qdo-axis dynamic model valid to predict the dynamic performance of the three-phase induction motor in a synchronous reference frame. **Draw** the dynamic qd-axis equivalent circuit.
(iv) **Show** the necessary modification(s) that should be applied to the model obtained in (iii) to describe the dynamic behaviour of the three-phase induction motor in both stationary and rotor reference frames. (***Do not write the model***)
(v) **Modify** the model obtained in (iii) to be represented in per unit variables.
(vi) **Show** how the steady-state voltage equations of the three-phase induction motor can be obtained from the qdo-axis dynamic model represented in stationary, rotor and synchronous reference frames. (***Do not write the equations***)
(vii) **Summarize** the advantages and disadvantages of the abc-axis model and the qdo-axis model.

(20 Marks)

P.T.O.

Continue Question number (2) **(28 Marks)**

b) **Derive** an expression of the electromagnetic developed torque (expressed in qdo-axis variables) of the three-phase induction motor. (5 Marks)

c) **Show** the relation between the inertia constant and the rotor stored energy (3 Marks)

Question number (3) **(20 Marks)**

a) **Derive** the expressions of both self and mutual inductance of the salient-pole synchronous machine. (5 Marks)

b) Consider a three-phase salient-pole synchronous machine, having one damper winding on the direct axis and one damper winding on the quadrature axis. **Answer** the following:

(i) **Write down,** aiding with appropriate drawing(s), the transformation matrices required to develop the qdo-axis dynamic model of this machine in the rotor reference frame.

(ii) **Write down** a complete qdo-axis dynamic model valid to describe the dynamic behaviour of this machine in the rotor reference frame when it operates as **a motor. Draw** the dynamic qd-axis equivalent circuit.

(iii) **Show** the necessary modifications that should be applied to the model obtained in (ii) to describe the dynamic behaviour of this machine when it operates as **a generator.**

(iv) **Show** how the steady-state voltage equations of the three-phase salient-pole synchronous machine can be obtained from the qdo-axis dynamic model represented in the rotor reference frame. (***Do not write the equations***)

(10 Marks)

c) **Derive** a linearized mathematical model by which the dynamic behaviour of a three-phase salient-pole synchronous **generator**, having no damper windings, can be predicted when the machine is subjected to a small disturbance. (5 Marks)

WITH MY BEST WISHES

Dr. Said M. Allam

Tanta University

Department: Electronics & Comm. Engineering
Total Marks:

Faculty Faculty of Engineering

Course Title: Electric Communications	Course Code:	Year: 4th
Date: January 2010 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches…etc)

Question number (1)

a) Explain the difference between external and internal noise

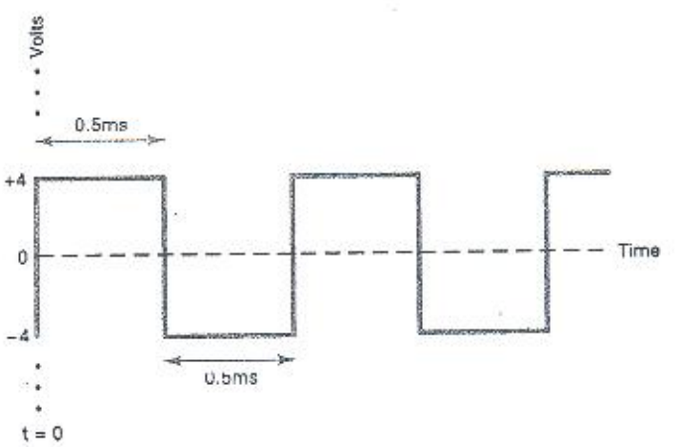
b) Calculate the noise power at the input of a receiver with an equivalent noise temperature of 45 K. Its fed from an antenna with a 35 K equivalent noise temperature and operates over a 5 MHz bandwidth ($k=1.38\times10^{-23}$ J/K) .

Question number (2)

a) A multistage system has six stages of gain from input to output .The power gains are 6, 3,10 , 4, 9 and 12 dB . What is the overall gain in dB ? What is the power of the output signal when the input is 0.15 W ?

b) For the train of square waves shown in Fig.1
(i) Determine the peak amplitudes and frequencies of the first four odd harmonics
(ii) Draw the frequency spectrum
(iii) Calculate the total instantaneous voltage for several times and sketch the time domain waveform

Fig.1



Problem number (3)

a) (i) Explain the difference between single tuned transformers and double tuned transformers.
(ii) Determine the overall bandwidth for :
- Two single tuned amplifiers each with a bandwidth of 10 kHz .
- Three single tuned amplifiers each with a bandwidth of 10 kHz .
- A double-tuned amplifiers with optimum coupling , critical coupling of 0.02 and a resonant frequency of 1 MHz

b) Prove that the power of the carrier is unaffected by the AM modulation process

P.T.O.

Question number (4)

(a) Sketch the block diagram of a PLL frequency synthesizers and explain its operation.

(b) A double –conversion receiver uses a 30 MHz first IF to receive 104 MHz signals, with an LO above the received frequency. What is the image frequency?
If the receiver has a second IF at 10.7 MHz , with the second LO also above the input frequency. What is the possible image frequency for the second IF? What would the image frequency be if a single conversion receiver with 10.7 MHz IF and high tracking LO were used?

Question number (5)

a) Sketch the block diagram of AM superheterodyne receiver and explain its operation.

b) Sketch the SSBSC FDM system block diagram and explain its operation .

Good Luck

Course Examination Committee

Prof. Mustafa M.Abd Elnaby
Dr. Heba Elkhoby
Prof. Mohamed Nasr
Dr. Abd Elfatah Abohashem

Course Coordinator: Prof. Mustafa Mahmoud Abd Elnaby

Tanta University

Department: Electrical Power and Machines Engineering
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Power System Protection | Course Code: EPM41 | Year: 4th
Date: Jan 30th 2010 (First term) | Allowed time: 3 hrs | No. of Pages: (2)

Answer the following questions

Problem number: (1) **(25 Marks)**

a) **What** is protective relaying? **Explain** the various functions of protective relaying? **State** the methods used for fault detection? (6 Marks)

b) What is the protective zone? Why the protective zones are arranged in overlap fashion? With the help of simple diagram, show how the zones are overlap? (6 Marks)

c) Explain what is meant by primary protection and backup protection? State the various methods used to provide backup protection? (6 Marks)

d) In the part of the network shown in Fig. 1: (7 Marks)
- Determine the zones of protection.
- Suggest relays used along the system to protect it against earth fault.

TR1: 220 MVA, 220/33 kV, Ynd11, %Z = 13%.
TR2: 40 MVA, 33/6.6 kV, Dyn11, %Z = 10%.
TR3: 300 kVA, 33/33 kV, Zigzag, %Z = 13%, used as earthing transformer.

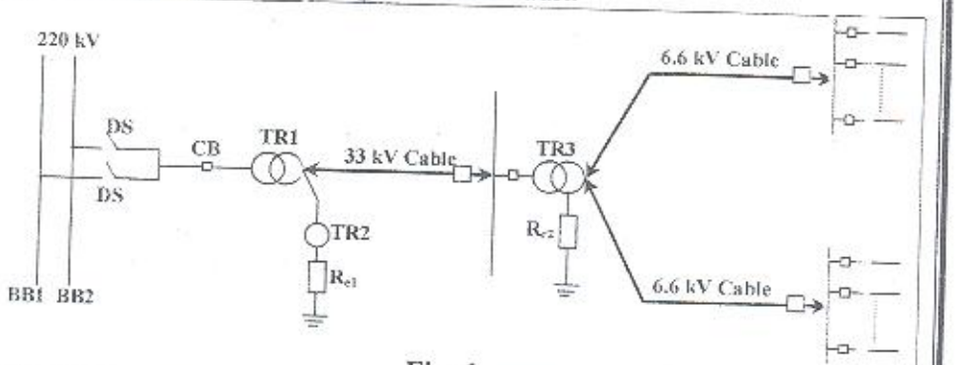


Fig. 1

Problem number: (2) **(20 Marks)**

a) Explain the following terms related to protective relays: (5 Marks)
i) Pickup ii) Dropout or Reset iii) Plug setting multiplier
iv) Time setting multiplier v) Relay burden vi) Overreach

b) Describe any one type of electromagnetic attracted armature type? (5 Marks)

c) Explain with the help of neat sketch, the construction and working of directional induction type overcurrent relay. (5 Marks)

d) Describe the operation of the following relays with neat sketch: (6 points)
- Balance beam relay used as plain impedance relay.
- Balance beam relay used as plain directional relay.
- Induction disc overcurrent relay.

Problem number: (3) **(20 Marks)**

a) What is IDMT characteristic of a relay? What is the procedure of setting IDMT relay? What initial data is required? How is the directional relay different than simple IDMT relay? (5 Marks)

P.T.O.

b) Choose time settings for the normal IDMT relays at R_1 and R_2 shown in Fig. 2 (7 Marks)

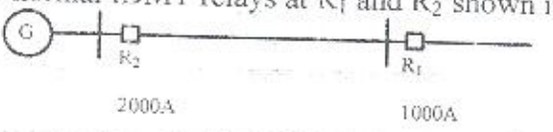


Fig. 2.

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

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

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 Marks)

Problem number (4) **(20 Marks)**

a) Explain what is meant by distance protection. What arrangement is made to make the relay measure positive sequence impedance only for single line to ground fault (SLG)? (5 Marks)

b) Explain why second zone of distance relay can be omitted in some cases and what's happen in this situation. (5 Marks)

c) Consider the multi-terminal line in the system shown in Fig. 3. 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
J	600
C	200
D	300
G	800
H	400

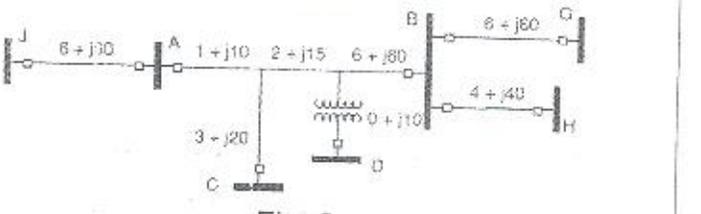


Fig. 3

d) 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. (10 Marks)

Good Luck

Course Examination Committee

Dr. Mohamed Abo Elazm
Dr. I Bedir
Dr. A. Azmy

قوى حديثة ١/٣٠

Tanta University

Department: Electrical Power and Machines Engineering
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Power System Protection
Date: Jan 30th 2010 (First term)
Course Code: EPM41
Allowed time: 3 hrs
Year: 4th
No. of Pages: (2)

Answer the following questions

Problem number (1) **(25 Marks)**

a) **What** is protective relaying? **Explain** the various functions of protective relaying? **State** the methods used for fault detection? (6 Marks)

b) What is the protective zone? Why the protective zones are arranged in overlap fashion? With the help of simple diagram, show how the zones are overlap? (6 Marks)

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220 MVA, 220/33 kV, Ynd11, %Z = 13%.

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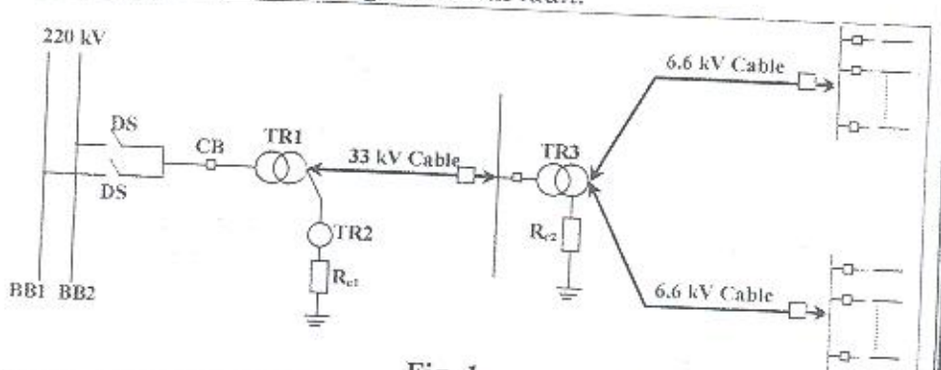

Fig. 1

Problem number (2) **(20 Marks)**

a) Explain the following terms related to protective relays: (5 Marks)
i) Pickup ii) Dropout or Reset iii) Plug setting multiplier
iv) Time setting multiplier v) Relay burden vi) Overreach

b) Describe any one type of electromagnetic attracted armature type? (5 Marks)

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Problem number (3) **(20 Marks)**

a) What is IDMT characteristic of a relay? What is the procedure of setting IDMT relay? What initial data is required? How is the directional relay different than simple IDMT relay? (5 Marks)

P.T.O.

Choose time settings for the normal IDMT relays at R_1 and R_2 shown in Fig. 2 (7 Marks)

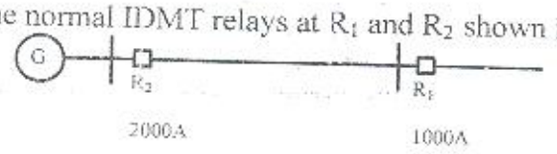

Fig. 2

Phase fault currents are shown.
Load current, through R_2 = 200A, and through R_1 = 75A.
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The time-current characteristic of the relay is given in the following table

Plug Setting Multiplier	2	3	5	10	15	20
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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 Marks)

Problem number: (4) **(20 Marks)**

Explain what is meant by distance protection. What arrangement is made to make the relay measure positive sequence impedance only for single line to ground fault (SLG)? (5 Marks)

Explain why second zone of distance relay can be omitted in some cases and what's happen in this situation. (5 Marks)

Consider the multi-terminal line in the system shown in Fig. 3. 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
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H	400

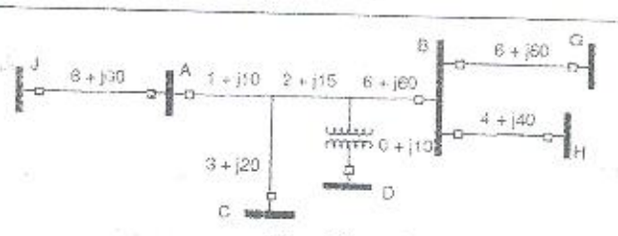


Fig. 3

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. (10 Marks)

Good Luck

Course Examination Committee

Dr. Mohamed Abo Elazm
Dr. I Bedir
Dr. A. Azmy

(قديم)

Tanta University

Department: Elec. Power and Machines Engineering
Total Marks: 60 Marks

Faculty of Engineering

Course Title: Electrical Testing and Measurements (1)	Course Code: EP4104	Year: 4th
Date: Jan. 25th 2010 (First term)	Allowed time: 3 hrs	No. of Pages: (1)

Remarks: (answer the following questions... assume any missing data... answers should be supported by sketches if possible)

Question number (1) **(12 Marks)**

a) **Show why** the starting current of three phase induction motor is higher than the rated current. **Explain** the different techniques used to decrease this current. (6 Marks)

b) **What** is a star-delta switch? **Can** it be used for any type of induction motors? **Draw** the connection diagram of this switch. (6 Marks)

Question number (2) **(12 Marks)**

a) **What** are the different techniques used to control the speed of the three phase induction motor? **Explain** the limitations of using each one **experimentally**. (6 Marks)

b) **Sketch and explain** the shape of an induction motor torque-speed characteristics curve. **Show how** the different speed control techniques affect the torque-speed characteristics of the three phase induction motor. (6 Marks)

Question number (3) **(12 Marks)**

a) **Write down** the conditions for connecting two synchronous generators in parallel. **Explain what happens** if one of these conditions is not achieved. **Show how** each one can be achieved **experimentally.** (12 Marks)

Question number (4) **(12 Marks)**

a) **Explain in details** how the equivalent circuit parameters of a single phase induction motor can be determined **experimentally. Draw** the equivalent circuit in each test **with appropriate measuring instruments.** (12 Marks)

Question number (5) **(12 Marks)**

a) **Show why** a synchronous motor can not start by itself. **What** are the techniques used to start this type of motor. (4 Marks)

b) **Explain** what happens to a synchronous motor as its field current is varied. **Show in details** how synchronous motor V curves can be obtained **experimentally**. **Illustrate** your answer with suitable drawing(s). (8 Marks)

WITH MY BEST WISHES

Dr. Said M. Allam

Tanta University Engineering

Department: Elec. Power and Machines Engineering
Total Marks: 75 Marks

Faculty of

Course Title: Application of Computer in Electrical Power Systems Course Code: EPM4119 Year: 4th
Date: January 25th 2010 (First term) Allowed time: 3 hrs No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches…etc)

Problem number (1) **(15 Marks)**

a) **Deduce** the admittance matrix model of tapping transformer, then sketch its equivalent circuit.

b) **Define** The following terms. (i) graph; (ii) tree; (iii) Cotree; (iv) branch; (v) link

c) **Prove that** the relation that used to insert new link between two old buses p and q in impedance bus matrix can be evaluated from:

$$Z_{bus}^{new} = Z_{bus}^{old} - \frac{\Delta Z \Delta Z^T}{Z_{ll}}$$

Where; $Z_{ll} = z_{pq} + Z_{pp} + Z_{qq} - 2Z_{pq}$

$$\Delta Z = \begin{bmatrix} Z_{1q} - Z_{1p} \\ Z_{1q} - Z_{1p} \\ . \\ . \\ Z_{mq} - Z_{mp} \end{bmatrix}$$

Problem number (2) **(30 Marks)**

a) 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.

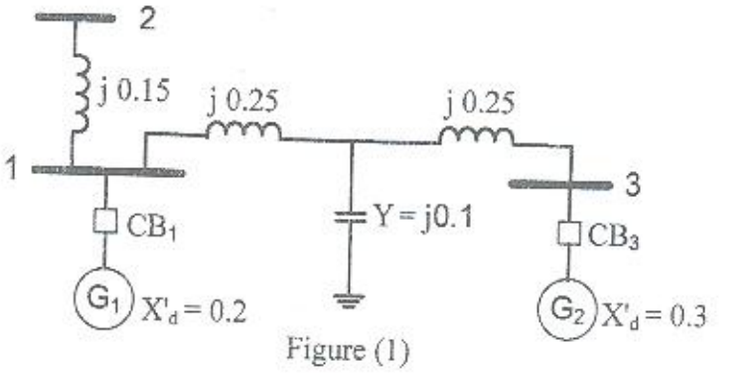


Figure (1)

(15 Marks)

b) (i) For system shown in Figure (1), using Fast decoupled method, start with initial estimates of $V_2^0 = 1\angle 0^0$ *p.u.* and $V_3^0 = 1.02\angle 0^0$ *p.u.*, **Calculate** the bus voltage magnitudes and their angles at bus 2 and 3 (only 2 iteration required).

P. T. O.

(ii) If after several iteration $V_2 = 0.988\angle -1.9889^0$ *p.u.* and $V_3 = 1.02\angle -1.1106^0$ *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.

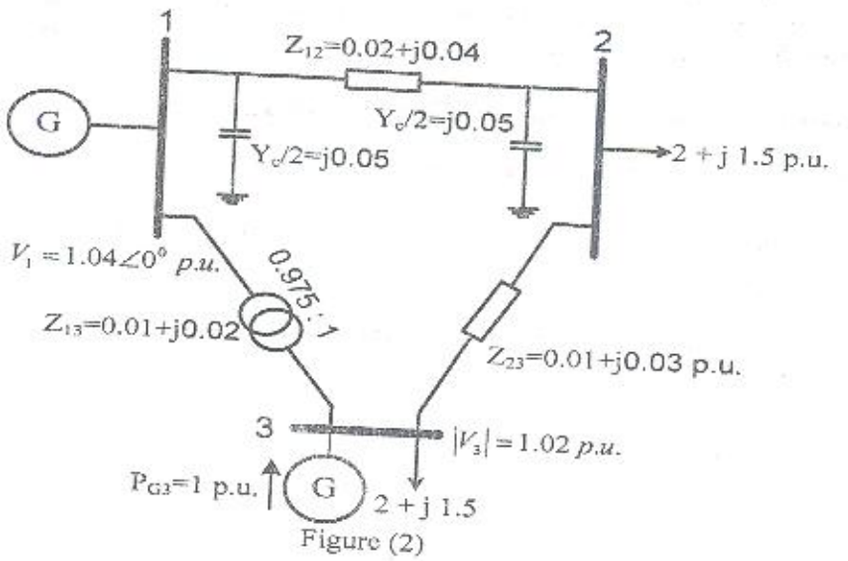


Figure (2)

Problem number (3) **(30 Marks)**

a) **Put ☑ or ☒ against the number of the following sentences then correct the false sentences.** (15 Marks)

1 The Gauss-Seidel method is a stable method for power flow solution.
2 The active and reactive power generations at regulated buses must be known before power flow solutions obtained.
3 The time required for one iteration in decoupled method is smaller than that required for fast-decoupled method.
4 The line to ground fault is important for determining the short circuit capacity of circuit breakers.
5 The fast decoupled method is the more sophisticated method for power flow solution.
6 In symmetrical three-phase system, negative and zero sequence is zero.
7 The more stable method of power flow solution is Newton-Raphson method.
8 Reactors are used at varies points in electrical power system to limit short circuit current.
9 The grounding is generally done at the supply end.
10 The Jacobian matrices are fixed and independent in iteration number in decoupled method

b) **Sketch** the rotor power angle of synchronous machine versus time for stable and unstable operations.

c) (i) **Write down** an algorithm of Gauss-Zeidel method of power flow solution.
(ii) **Write down** a MATLAB program that used to evaluate the fault current due to three-phase symmetrical fault.

(With My Best Wishes)
Dr. Ibrahim Bedir

قوى كهربية مدني

Tanta University

Department: Elec. Power and Machines Engineering
Total Marks (electric part): 70 Marks

Faculty of Engineering

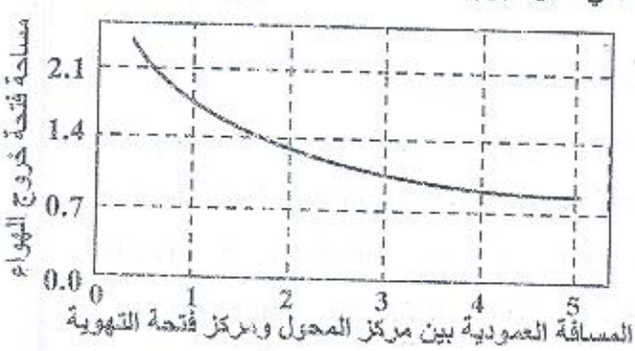
Course Title: Electrical Installations	Course Code: EPM4121	Year: forth year
Date: January 2010 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Problem number (1) (15 Marks)

أ- وضح أسباب اختلاف المقاومة للتيار المستمر عن المقاومة للتيار المتردد في الكابلات مع ذكر العوامل التي تتوقف عليها هذه الأسباب (٥ درجات)

ب- صمم حجرة خاصة لمحول ١٦٠٠ ك.ف.أ. وحدد أبعاد فتحة التهوية بدون شبك علما بأن المحول سيوضع على حوامل حديدية بارتفاع ٧٠ سم. استخدم الجدول و المنحني المرفقين. (٥ درجات)

قدرة المحول ك.ف.أ.	الطول (سم)	العرض (سم)	الارتفاع (سم)	ارتفاع جسم المحول (سم)
٦٢٠	١٨٥	١٠٢	١٩٥	١٠٠
١٦٠٠	٢٢٠	١٤٠	٢٨٠	١٦٠
٢٠٠٠	٢٤٠	١٥٥	٣٠٠	١٧٠
٣٠٠٠	٢٦٠	١٧٠	٣٢٥	١٨٠



ت- يراد حماية كابل ألمنيوم بطول ٢٦٠م ومساحة مقطع ٧٠ مم٢ باستخدام نبضية حماية مزودة بإعتاق مغناطيسي. فإذا كانت فولطية التشغيل تساوي ٤٨٠ فولت ومساحة مقطع الحيادي تساوي نصف مساحة مقطع الوجه وقيمة الأعتاق المغناطيسي ١٣٠٠ أمبير ويوجد ٣ كوابل متساوية المقطع ومتصلة بالتوازي، بين ما إذا كان يمكن حماية الكابل عند جميع ظروف التشغيل. استخدم معاملات التصحيح من الجداول المرفقة. (٥ درجات)

V	220	400	415	440	480	500	660
K_1	0.58	1.05	1.11	1.16	1.26	1.31	1.73

عدد الكوابل	2	3	4	5	6
K_2	2	2.65	3	3.2	3.33

Problem number (2) (20 Marks)

أ- اذكر أهم الاعتبارات التي يجب مراعاتها عند تنفيذ الإضاءة في الأماكن التالية: (٥ درجات)
١- المكاتب الخاصة ٢- المستشفيات ٣- القاعات الدراسية

ب- بين إمكانية تغذية محرك أحادي ٥٠٠ فولت بكابل نحاسي طوله ٤٠٠م ومساحة مقطعه ٣٥ مم٢ عند تيار تشغيل عادي ٨٠ أمبير بمعامل قدرة ٠.٨ وتيار بدأ إقلاع ٤٥٠ أمبير بمعامل قدرة ٣٥%. أقصى فقد للفولطية مسموح به على أطراف المحرك ٨%. فقد الفولطية في الكابل الرئيسي المغذي للوحة المحرك عند تيار التشغيل العادي =٦ فولت، وتيار الكابل الرئيسي ٦٠٠ أمبير. يمكنك استخدام جدول فقد الفولطية المرفق (فقد الفولطية بين الأطوار بالفولت/أمبير/كم للمحركات). (٧ درجات)

مقطعه الكابل مم٢		دارة محركات أحادية الطور		دارة محركات ثلاثية الطور	
نحاس	ألومونيوم	تشغيل عادي Cos ϕ = 0.8	بدأ الإقلاع Cos ϕ = 0.35	تشغيل عادي Cos ϕ = 0.8	بدأ الإقلاع Cos ϕ = 0.35
٢٥	٣٥	١.٥	٠.٧٥	١.٣	٠.٦٥
٣٥	٥٠	١.١٥	٠.٦	١	٠.٥٢
٥٠	٧٠	٠.٨٦	٠.٤٧	٠.٧٥	٠.٤١
٧٠	١٢٠	٠.٦٤	٠.٣٧	٠.٥٦	٠.٣٢

ت- بين أهمية التاريض للأجسام المعدنية المكشوفة ووضح تاثيره على جهد الجسم المعدني المكشوف عند حدوث قصر (٨ درجات)

P.T.O.

Problem number (3) **(20 Marks)**

a) Define the planning phase of switchgear installation. (5 points)

b) What are the main functional requirements for each of: busbar – circuit breaker – disconnector switch – load break switch? (5 points)

c) State the types of cooling used for power transformers. (5 points)

d) Aided with clearly drawings, state the types of busbar layout. (5 points)

Problem number (4) **(15 Marks)**

A cement plant is supplied from 220 kV grid. Supplying will happen by opening an OHTL passing at a distance of 700 m from the plant. The substation will be a double busbar, air-insulated system and two step down 40 MVA transformers. Transformers are used to step down the voltage to 11 kV for using within the plant. For the abovementioned system, answer the following points:

a) Determine the number of towers required from the opening point to the substation.
b) Determine the number of bays required for this substation.
c) Determine the area required for this substation
d) Draw the single-line diagram for this substation
e) Draw the layout of the high voltage equipments in the substation yard.

Good Luck

Course Examination Committee

Dr. Ahmed Refaat
Dr. Saeed Allam
Dr. Mohamed Abo El Azm
Prof. Mohamed Tantawy

Course Coordinater: Dr. Ahmed Refaat

قوى كهربية قديم

Tanta University

Electrical Power and Machines Department
Total Marks: 85 Marks
Course: Especial Machines — Code: EP4103
Third Year — Time: 3:00 hrs — First Term
Date: Jan 27, 2010 — Pages: 2

Faculty of Engineering

ANSWER THE FOLLOWING QUESTIONS, ASSUME ANY MISSING INFORMATION AND SUPPORT YOUR ANSWER WITH DIAGRAMS AND SKETCHES

Question 1: Marks: **25**

a. Describe four different methods for starting of single phase induction motor. Support your answer with connection diagrams. Compare between the [10]

Show the difference between the methods used for the starting of single-phase induction motor.

b. A 1/4hp, 1ϕ, 120V, 60Hz, 1730rpm induction motor has stator winding resistance R_1=2.9Ω, magnetizing reactance X_{mag}=55.72Ω, and rotor resistance and leakage reactance referred to stator R'_2=2.7Ω, X'_2=3.26Ω. The rotational loss is 72.94W. Determine: [15]

(a) input current
(b) input power factor
(c) developed torque
(d) Output power
(e) Efficiency.

The stator leakage reactance is assumed equal to the rotor leakage reactance referred to stator.

Question 2: Marks: **20**

a. Compare between each pair of the following: [6]

1. Soft shopping and hard chopping
2. Pulse width modulation and current regulation

b. Define each of the following quantities: [4]

1. Detent torque
2. Position sensor

c. Explain the principle of operation and main characteristics of the following machines: [10]

1. Universal Motor
2. Synchronous reluctance motor

Support your answer with necessary diagrams and graphs.

Question 3: Marks: **20**

a. State the difference between the drive circuits needed for operation of variable reluctance and permanent magnet steeper motors. [6]

b. Describe the principle of operation of hybrid steeper motors. Use two stacks-8/6 hybrid steeper motor to explain your answer and provide necessary diagrams. [6]

c. A variable reluctance stepping motor has 40 stator teeth, 50 rotor teeth. It is driven at 400 pulses per second. Determine (a) step angle (b) resolution (c) motion speed (d) Number of pulses required to rotate the shaft through 54°. [8]

Question 4: Marks: **20**

a. Compare between switched reluctance machine and stepper motor from the point of view of operation, construction and power electronics required. [5]

b. Explain the effect of switching-on and switching-off angles on the current wave form and produced torque of switched reluctance motor. [5]

c. A three phase 6/4 VRM has stator pole angle $\beta=30°$, rotor pole angle $\alpha=34°$, air gap length $g=3\times10^{-2}$cm, active length=8cm. The stator and rotor iron can be considered to be of infinite permeability. [10]

1. Defining the zero of rotor angle at the position of phase-1 full alignment, plot with labels the inductance of the three phases' variation against rotor position.
2. Find the current of phase-1 required to produce flux density of 1.0T when phase-1 is in the position of maximum inductance. Make any required assumptions.

WITH BEST WISHES