Electrical Machines
F3-6032

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

Probatoire Technique Examination

JUNE 2016 **Date: Wednesday 25-05-2016**

Series/ Specialties	Electrical Technology (F3)
Subject Title	Electrical Machines
Subject Code No.	F3-6032
Type of Exam	WRITTEN
Weighting (Coef.)	SEE INSIDE

Duration: 8:00 - 11:00

General Instructions

You are reminded of the necessity for good English and orderly presentation of your material.
Where calculations are involved show your working, giving your answer at each stage.

Content: QUESTIONS

Specific Instructions

Turn over

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PROBATOIRE DE TECHNICIEN
Session: 20.....
Series F3 – Electrotechnology
Duration: 03H
Coefficient: 03
Written Paper

ELECTRICAL MACHINES

No document is authorized except those given to the candidates by the examiners.
The paper has 2 parts.
Number of pages: 2, from 1/2 to 2/2.

PART I : TECHNOLOGY — **6mks**

1- Indicate how the direction of rotation of direct current motors is changed. — **1mk**
2- The compound excited motor is not raced on no load: Explain why. — **1mk**
3- The motor started with the aid of a permanent capacitor is a single-phase motor:
   a) State its working principle. — **1mk**
   b) Indicate its two main areas of application. — **1mk**
4- Indicate two methods of reducing iron losses an induction motor. — **1mk**
5- Cite two conditions to be fulfilled for three-phase transformers to be coupled in parallel. — **1mk**

PART II : ELECTROTECHNICS — **14mks**

EXERCISE 1 : Direct current machine — **4mks**

A shunt generator produces on load an e.m.f of 180V; the field resistance r= 25Ω; the field carries a current i =6A. This generator is charging a battery whose internal resistance r'=0.1Ω and is drawing 40A. The battery e.m.f. E=100V. The charging current is limited by a rheostat whose resistance Rh is connected in series with the battery.

1-Draw the diagram of circuit assembly. — **1mk**
2-Calculate the voltage across the armature. — **0.5mk**
3-Determine the armature current. — **0.5mk**
4- Calculate armature resistance R . — **0.5mk**
5-Calculate:
   a) The voltage across the battery. — **0.5mk**
   b) The voltage across the rheostat. — **0.5mk**
6- Determine the value of the rheostat resistance Rh. — **0.5mk**

EXERCISE 2 : Single-phase transformer — **5mks**

A manufacturer manual gives the characteristics of a single-phase transformer
-frequency f=50Hz
- Apparent power: 100KVA
- primary effective voltage: 20 KV

- secondary open circuit effective voltage: 410V.
-open circuit losses under primary nominal voltage: 0.21KW
-full load joule losses: 2.15KW
The effective value of the primary short-circuit voltage is 0.8KV. The primary short-circuit current is 125A. The transformer is supplying an inductive load with a power factor of 0.8.
In these conditions, the full load secondary voltage drop is 15.375V.
Calculate:

1-The effective value of the full load secondary voltage. **1mk**
2- The effective values of the primary and secondary nominal current. **2mks**
3- The transformer full load efficiency. **1mk**
4- Determine the resistance Rs and the reactance Xs of this transformer model viewed from the secondary. **1mk**

EXERCISE 3 :Alternating current machine **5mks**

Experimental study is carried out on a three-phase 4-pole induction motor connected to a
Three-phase, 220V/380V 50Hz network.
Here below designated, are:
-P_u motor useful power;
-I the effective value of a line current;
-P_a the total active power consumed
Results are recorded in the table here below:

Regime	P_u(W)	n(tr /mn)	I(A)	P_a(W)	g	cosφ	Efficiency
No load	0	1490	1,5A	260			
Nominal	1500	1360	3,9	1900			

1-Complete the above table while indicating the formula used. **0.25mkx6**
2- The powers balance sheet is now studied in the nominal regime.
For this operating regime,
the following are recorded:
-losses in the stator iron: 70W
- Mechanical losses: 100W;
- Stator joule losses: 57W;
Calculate:

a-The power transmitted to the rotor; **0.75mk**
b-The rotor joule losses; **0.75mk**
c- The useful power and the efficiency of the motor; **1mk**
D-Compare the results obtained with those of table and conclude; **1mk**