TECHNICAL UNVERSITY OF MOMBASA

Faculty of Engineering & Technology in Conjunction with Kenya Institute of Highways and Building Technology (KIHBT)

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

HIGHER DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

EEE 3214: POWER SYSTEMS II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2014
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *A non-programmable Scientific Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) Discuss any THREE methods for power factor improvement. **(6 marks)**

b) Derive an expression for the most economical value of power factor which may be attained by a consumer. **(4 marks)**

c) A system is working at its maximum KVA capacity with a lagging power factor of 0.7. An anticipated increase of load can be met by one of the following two methods:

(i) By raising the p.f of the system to 0.866 using phase advancing equipment.
(ii) By installing extra generating plant

If the total cost of the generating plant is US$100 per KVA. Estimate the limiting cost per KVA of phase advancing equipment to make its use more economical than the additional generating plant. Internet and depreciation charges may be assumed to be 105 in each case. **(10 marks)**

Question Two

a) Describe briefly any TWO different types of D.C. distributors. **(4 marks)**

b) With the aid of a labeled diagram explain the use of rotary balances in a 3-wire dc distribution system. **(6 marks)**

c) A 2-wire d.c. ring distributes is 300m long and is fed at 240V at point A. At point B 150m from A, a load of 120A is taken and at C, 100m in the opposite direction a load of 80A is taken. If the resistance per 100m of single conductor is 0.03 1Ω , determine:

(i) Current in each section of the distributes
(ii) Voltage at point B and C **(10 marks)**

Question Three

a) Explain how a.c. distribution differs from d.c. distribution. **(4 marks)**

b) Figure 1 shows a 3-phase ring main ABCD fed at A at 11KV and supplies balanced loads of 50a AT 0.8pf lagging at B. 120A at unity p.f. 120A at unity p.f at C and 70A at 0.866 lagging at D, the load currents being referred to the supply voltage at A. The impedance of the various sections are as shown in the diagram below. Calculate the currents at various sections and stations bus-bar voltages at B, C and D. **(16 marks)**

Figure 1

Question Four

a) Discuss the importance of voltage control in the modern power system. **(4 marks)**

b) (i) With the aid of a diagram describe the operation of a an off-load tap changing transformer method of voltage control.

(ii) State any TWO limitations of the regular in b(i) **(8 marks)**

c) A load of 10,000KW at a power factor of 0.8 lagging is supplied by a 3-phase line whose voltage has to be maintained at 33kV at each end. If the line resistance and reactance per phase are 5 1Ω and 10 1Ω respectively, calculate the capacity of the synchronous condenses to be installed for the purpose. Comment on the result. **(8 marks)**

Question Five

a) Explain the following with regard to short circuits in a power system.

(i) Why do we choose a base KVA in short circuit calculations?

(ii) State TWO harmful effect of short-circuit faults

(iii) Causes to short circuit **(10 marks)**

b) Figure 2 below shows a 3-phase transmission line operating at 10KV and having a resistance of 1 1Ω and reactance of 4 1Ω is connected to the generating station bus-bars through 5MVA step-up transformers having a reactance of 5%. The bus-bars are supplied by a 10MVA alternator having 10% reactance. Calculate the short-circuit kVA fed to symmetrical fault between phases if it occurs:

(i) At the load end of transmission line

(ii) At the high voltage terminals of the transformer. **(10 marks)**

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