THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

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

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

HIGHER DIPLOMA IN ELECTRICAL POWER ENGINEERING

EEP 3304 : POWER SYSTEMS ENGINEERING III

SEMESTER EXAMINATIONS

SERIES: AUGUST/SEPTEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Non-programmable calculator*

Answer Question **ONE** (**COMPULSORY**) in **section I** and any other **TWO** questions from **Section II**
This paper consists of **THREE** printed pages

SECTION I (compulsory **–** 30 marks)

Question 1

a) (i) State conditions necessary for operating generators in parallel (4 marks)

(ii) Explain the effect on generator output KW on varying

(i) Prime mover speed
(ii) Power factor
(iii) Excitation (6 marks)

b) Two 3phase 6.6kv star connected alternators supply a load of 3.0 MW at 0.8lag in a 1:2 ratio. The synchronous impedance per phase of machine X = (0.8 + j30) ohms and that of Y = (0.6 + j 14) ohms. The excitation of machine X is adjusted so that it delivers 200A at a lagging p.f.

Determine for each machine
(i) Current
(ii) P.f (12 marks)

c) Briefly explain the following compensation methods of long overhead lines
(i) Series
(ii) Shunt
(iii) Synchro
(iv) Transformer tap (8 marks)

SECTION II (Answer any **TWO** questions **–** 40 marks**)**

Question 2

a) List any **THREE** factors that affect sag (3 marks)

b) A conductor hangs in the form of a catenary Y = C cosh x/c where c = 1525m. The span is 305m and conductor weighs 1.49kg/m. Calculate:

(i) Length of conductor
(ii) Sag
(iii) Maximum and minimum values of tension using the catenary method (17 marks)

Question 3

a) Draw the equivalent circuit and the phasor diagrams for a nominal 'T' method of line representation (5 marks)

b) A three phase 50HZ overheadline is 100km long. The phase values of resistance inductance and capacitance per km are 0.15ohm; 1.2mH; 0.008 μF. The line supplies a load of 70MW; 0.8 lag at 132KV. Using the nominal π method, calculate:
(i) Line efficiency

(ii) Total line loss (15 marks)

Question 4

a) State the main reason for 'short circuit fault level' studies (3 marks)

b) For the system below, take 40MVA and 6.6 KV as base ratings and calculate for a 3phase balanced fault

(i) Short circuit current and MVA fault level at F_1
(ii) Short circuit current and MVA fault level at F_2 (17 marks)

Question 5

a) Compare arc extinction process for the following circuit breakers:
(i) Bulk oil; plain break
(ii) Bulk oil; explosion pot
(iii) SF_6 Gas blast (6 marks)

b) With aid of a breaker oscillogram indicate the following

(i) Peak restriking voltage
(ii) Recovery voltage
(iii) Arc voltage
(iv) Current zero (10 marks)

c) State:

(i) **TWO** methods used for voltage equalization across circuit breaker poles

(ii) The **TWO** major operational disadvantages of the SF6 circuit breaker (4 marks)