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

EEA 3163: ELECTRICAL TECHNOLOGY II

SPECIAL/SUPPLEMENTARY 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 **FOUR** printed pages

Question One

a) With regard to mutually coupled coils, explain:
- **(i)** The maximum possible coefficient coupling
- **(ii)** How can such coupling be obtained
- **(iii)** Typical value of this coefficient between two air cored RF coils. **(6 marks)**

b) Derive the necessary expression for calculating the inductance of a coil. **(6 marks)**

c) (I) A ring of stalloy stamplings having a mean circumference of 400mm and a cross-sectional area 500mm^2 has 200turns. Determine the inductance of coil corresponding to the reversal of current of:
- **(i)** 1A
- **(ii)** 5A

(II) If the core is non-magnetic determine inductance of coil tube the following B-H curve:

B	1.2	1.3	1.4	1.5	1.55	1.6
H	400	500	650	900	1300	2500

(8 marks)

Question Two

a) (i) State the maximum power transfer theorem.

(ii) Derive the condition for maximum power transfer in a.c. circuits. **(6 marks)**

b) A circuit has a resistance of 6Ω and a capacitance reactance of 8Ω in series. A voltage V = 141 sin 314t is applied. Determine:
- **(i)** Value of complex impendence
- **(ii)** Expression for current
- **(iii)** Power factor
- **(iv)** r.m.s values of voltage and current
- **(v)** Real power
- **(vi)** Reactive power draw the phasor diagram. **(7 marks)**

c) A voltage 10V(rms) at a frequency of $10^6/\pi$ Hz is applied to points AB of the circuit shown in figure 1. Determine current I_1 in steady state conditions. L_1 = 5mH . L_2 = 1mH, M_{12} = 2mH, R_1 = 10KΩ, R_2 = 5 $K\Omega$ **(7 marks)**

R_1

Question Three

a) Define the term "bandwidth" **(2 marks)**

b) Derive the expressions for resource frequency. **(4 marks)**

c) A constant voltage at a frequency of 1MHz is applied to a choke coil in series with a variable capacitor. When the capacitor is set at 500pF, the current in the circuit is maximum. When the capacitance is 600pF, the current is half the maximum value. Determine:

(i) Resistance
(ii) Inductance
(iii) Factor of the choke coil **(7 marks)**

d) A voltage $V = 10\sin \omega t$ is applied to a series RLC circuit. At resonance the voltage across capacitor is 500V. The band width is 400rad/s and impedance at resource is 100 Ω. Determine:

(i) ω_r ,lower and upper half power frequencies.
(ii) L and C **(7 marks)**

Question Four

a) For the network of figure 2, determine:

(i) I^1, I^2 and I_3 with switch S at A
(ii) I_1, I_2 and I_3 with switch S at B
Using the principle of super position. **(7 marks)**

C

b) In the circuit of figure 3 the resistance have the following values in ohms Ra = 20 Ω, R_b = 30 Ω, R_c = 50 Ω, R_d = 24 Ω, R_e = 5 Ω. Determine the current supplied by the battery. **(6 marks)**

c) Determine the currents through the different branches of the network shown in figure 4. **(7 marks)**

Question Five

a) Derive the necessary equation for:
   (i) Rise of current in an inductance circuit when it is connected to a dc source.
   (ii) Decay of current in an inductance circuit when it is disconnected from the source. **(8 marks)**

b) In the circuit of figure 5, the switch is put on position 'a':
   (i) Find expression for charging current.
   (ii) After a long time the switch is put on position 'b'. Determine expression for current through 0.1mΩ resistor.
   (iii) Determine time constant of current in part (ii) **(12 marks)**