**SOUTH EASTERN KENYA UNIVERSITY**

**UNIVERSITY EXAMINATIONS 2016/2017**

**FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR**

**SCIENCE IN ELECTRONICS**

**ELC 301: AC CIRCUIT THEORY**

**5TH DECEMBER, 2016**

**INSTRUCTIONS TO CANDIDATES**

**TIME: 1.30-3.30 P.M**

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Question one carries 30marks while the rest carry 20marks each

Answer **Question One** and any **other two** questions

**Question One (30mks)**

**a)** Explain what is meant by the following as used in electrical circuits

**(i)** Coupling

**(ii)** Impedance matching

**b)** State two advantages of A.C signals over D.C signals

**c)** State the *dot* convention as used in coupled circuits

(2mks)

(2mks)

(2mks)

(2mks)

**d)** A low pass filter is composed of T-sections with inductance of 50 *mH* in each series arm and a

capacitance of 4.0*F*

in the shunt arm. Determine the cut-off frequency of the filter

(4mks)

**e)** Express *Z* *7* *j10* in polar forms

**f) (i)** State three properties of a phasor

**(ii)** Given two vectors *A* *10**450* and *B* *5**1200* determine their sum

**g)** In parallel a.c circuit explain the following quantities giving their symbols and units

(3mks)

(3mks)

(4mks)

**(i)** Admittance

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(2mks)

**(ii)** Susceptance

(2mks)

**h)** An AC voltage with amplitude of 15V and a frequency of 60 Hz is applied across an inductor whose

inductance is 30 mH. Find the resulting AC current.

**Question Two (20mks)**

**a)** For coupled circuits,

4mks)

show that; *K*

*M*

*L*1*L*2

where K, L and M have their usual meaning

(7mks)

**b)** Derive the expression for reflected impedance as used in coupled circuit explaining the symbols

used

**c)** State three main characteristics of an ideal transformer

**d)** Define a two-port network circuit and state the equations for the Z- and ABCD-

parameters

**Question Three (20mks)**

**a)** Explain the following filters

**(i)** Low pass filters

**(ii)** High pass filters

**(iii)** Bandpass filters

**b)** Differentiate between T -section and -section low pass filter

**c)** The secondary current to an ideal transformer rated at 110/3300 V is 3 A. Calculate the:

**(i)** the turn ratio,

**(ii)** kVA rating,

(iii) secondary current

**d)** State and explain two reasons for impedance matching in RF circuits

(5mks)

(3mks)

(5mks)

(6mks)

(4mks)

(2 mks)

( 2 mks)

(2mks)

(4mks)

**Question Four (20mks)**

**a)** The admittance of a circuit is0.04 *j*0.03 Siemens. Find the values of the resistance and reactance

of the circuit if they are joined in series.

(6mks)

**b)** Two impedances given by Z1 = (10 + j 5) and Z2 = (8 + j 6) are joined in parallel and connected

across a voltage of V = 200 + j0.

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**(i)** Sketch the circuit diagram

**(ii)** Determine the two branch currents

**(iii)** Calculate the circuit current and phase

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(2mks)

(8mks)

(4mks)

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**Question Five (20mks)**

**a)** Given

that

for

RLC

series

resonant

circuits,

the

average

power

is

given

by;

*Pave*

*Vrms*2 2

2



Where *Q* is the quality factor,*o* is the resonance frequency

Explain what happens to this average power at resonance.

(4mks)

**b)** A series resonant circuit has R *2**,* C *0.1*F and *L* 1.0 *mH* , find resonance frequency, o ,

bandwidth B and quality factor Q .

(6mks)

**a)** A resistance of 20 Ω, an inductance of 0.2 H and a capacitance of 100 μF are connected in series

across 220-V, 50-Hz mains. Determine the following

**(i)** impedance

**(ii)** voltage across R, L and C

**(iii)** angle of lag

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(4mks)

(4mks)

(2mks)

*o*



2 2

2 2

*R* *Q*

*o*