NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF ELECTRONIC ENGINEERING

NETWORK THEORY

TEE 2101

Examination Paper

December 2014

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: N/A

Examiner's Name: MRS M.B.NLEYA

INSTRUCTIONS

1. Answer any FIVE (5) questions
2. Each question carries 20 marks
3. Use of calculators is permissible

MARK ALLOCATION

QUESTION	MARKS
1.	20
2.	20
3.	20
4.	20
5.	20
TOTAL	100

QUESTION 1

The switch in the circuit in Figure Q1 has been closed for a long time. It is open at t = 0.

Find: a) i (0^+) and v(0^+), b) di(0^+)/ dt and dv(0^+)/dt, c)i(∞) and v(∞) [20]

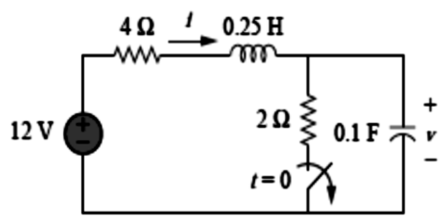

Figure Q1

QUESTION 2

a) The voltage v = 12cos (60t + 45°) is applied to a 0,1 H inductor. Find the steady-state current through the inductor. [4]

b) Briefly give the expression and waveform representation of each of the following functions: unit step function, unit impulse function and ramp function. [16]

QUESTION 3

Find the g parameters as functions of s for the circuit in Figure Q3. [20]

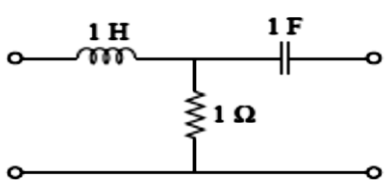

Figure Q3

QUESTION 4

Describe the classification of filters and show one example of active low pass filter. [20]

QUESTION 5

Use the Laplace transform to solve the differential equation below: [20]

$$\frac{d^2v(t)}{dt^2} + 6\frac{dv(t)}{dt} + 8v(t) = 2u(t) \quad \text{subject to} \quad v(0) = 1,\ v'(0) = -2.$$

QUESTION 6

In the circuit of Figure Q6 find i_o, v_o and i for all time, assuming that the switch was open for a long time. [20]

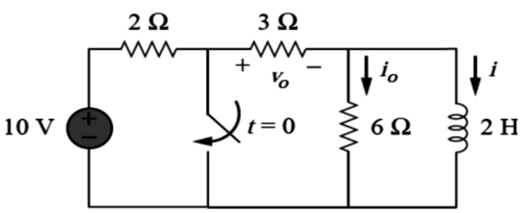

Figure Q6

QUESTION 7

Find v_0 in the circuit in figure Q7 using the superposition theorem [20]

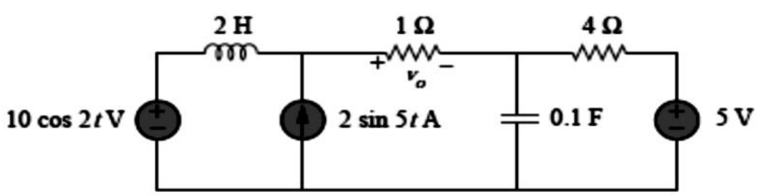

Figure Q7

End of the paper

Appendix

A1 Laplace transform pairs

$f(t)$	$F(s)$
$\delta(t)$	1
$u(t)$	$\frac{1}{s}$
e^{-at}	$\frac{1}{s+a}$
t	$\frac{1}{s^2}$
t^n	$\frac{n!}{s^{n+1}}$
te^{-at}	$\frac{1}{(s+a)^2}$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
$\sin(\omega t+\theta)$	$\frac{s\sin\theta+\omega\cos\theta}{s^2+\omega^2}$
$\cos(\omega t+\theta)$	$\frac{s\cos\theta-\omega\sin\theta}{s^2+\omega^2}$
$e^{-at}\sin \omega t$	$\frac{\omega}{(s+a)^2+\omega^2}$
$e^{-at}\cos \omega t$	$\frac{s+a}{(s+a)^2+\omega^2}$

A2 G parameters

$$\mathbf{g}_{11} = \left.\frac{\mathbf{I}_1}{\mathbf{V}_1}\right|_{\mathbf{I}_2=0}, \qquad \mathbf{g}_{12} = \left.\frac{\mathbf{I}_1}{\mathbf{I}_2}\right|_{\mathbf{V}_1=0}$$

$$\mathbf{g}_{21} = \left.\frac{\mathbf{V}_2}{\mathbf{V}_1}\right|_{\mathbf{I}_2=0}, \qquad \mathbf{g}_{22} = \left.\frac{\mathbf{V}_2}{\mathbf{I}_2}\right|_{\mathbf{V}_1=0}$$