TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF TECHNOLOGY IN ELECTRICAL & ELECTRONIC ENGINEERING

TEE 4201: ELECTRICAL CIRCUIT THEORY 1

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME 2 HOURS

DATE: Sep 2018

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions; Question ONE is compulsory. In addition attempt any other TWO questions.

Do not write on the question paper

QUESTION ONE. (Compulsory 30 marks)

a. An alternating current is represented by i=141.4sin377t.Determine the:

i. Maximum value
ii. Frequency
iii. Time period
iv. Instantaneous value of voltage when t=3ms (4marks)

b. Two currents represented by 50sin314t and 30sin (314t-π/6) are fed to a common conductor. Determine the expression for the resultant in the form i=Isin(314t+ϕ) (4marks)

c. Express these sinusoids as phasors

i) -7cos(2t+40^o) ii) i=4sin(10t+10^o) (4marks)

d. Given **V**=j8e^{-j20} and **I**=-3+j4, find the sinusoids represented by these phasors (4marks)

e. Find the voltage v(t) in a circuit described by the integro-differential equation

$2\frac{dv}{dt} + 5v + 10\int vdt = 20\cos(5t - 30°)$ using the phasor method (5marks)

f. Draw ac waveforms showing the phase relations between voltage and current for i) Resistor ii) Inductor iii) Capacitor (3marks)

g.A voltage v(t)=141.4sin(314t+10) is applied to a circuit and the steady current given by i(t)=14.14sin(314t-20) is found to flow through it

Determine:

i.The power factor of the circuit

ii.The power delivered to the circuit

iii.Draw the phasor diagram (6marks)

QUESTION TWO

a. A voltage is applied to a series R-L circuit. Obtain the phasor representing the voltage across L and explain how the magnitude of this voltage varies with frequency (5marks)

b. A two element series circuit carries a current v(t)=141.4sin(314t+10), exciting voltage being v(t)=141.4sin(314t+10).Determine:

i. Circuit element values

ii. Average and reactive powers

iii. Peak value of the instantaneous dissipated power (8marks)

c. In the circuit of Fig. Q(2) determine the:

i. Rms current I

ii. Rms voltages V_R, V_c, V_e

iii. Capacitance C

iv. Draw the the phasor diagram phase angle I $and V_x, I\ and\ V_e$ between and phase angle (7marks)

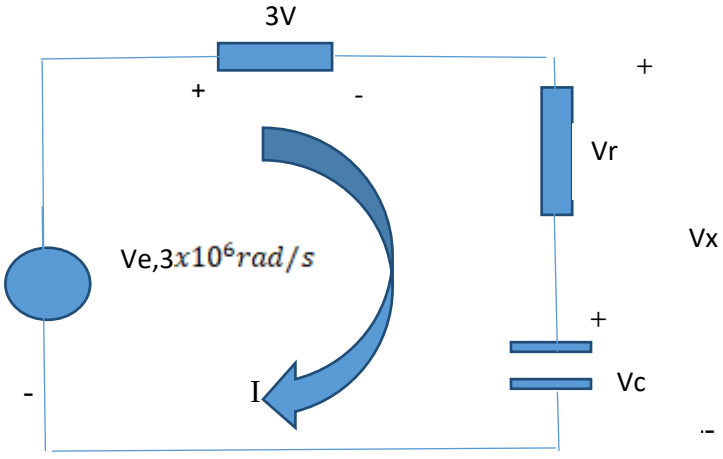


Fig.Q(2)

QUESTION THREE

a. Explain with aid of sketches the meaning of the following terms

i. Step response

ii. Impulse response (4marks)

b. Consider the circuit of Fig and determine the expression and sketch for V_c (7marks)

c. Given that the voltage across a 5μF capacitor is V=20 v(t)=141.4sin(314t+10),.Determine the:

i. phasor current

ii. Steady state sinusoidal current (4marks)

d. A coil of inductance of 0.5H and resistance 90 is connected in parallel with a capacitor of value 20F. The circuit is connected to an a.c. source voltage of 230V, 50Hz.

Determine the:

i. Current drawn from the source

ii. Power factor of the circuit (5marks)

QUESTION FOUR

a. I .State Nortons theorem as applied to any ac two terminal active linear network

Ii . Determine the current which will flow through an impedance of $(10 - j20)$ across terminals A and B of the circuit shown fig(4a).

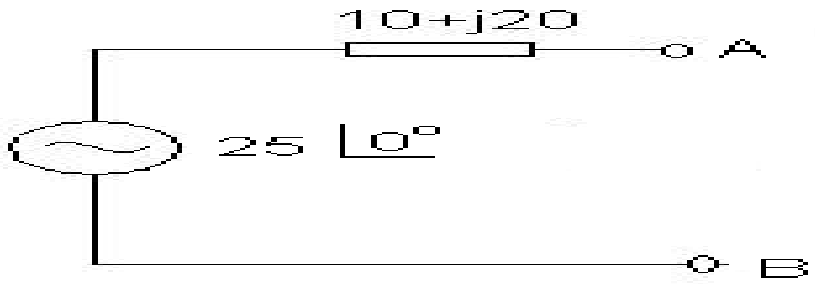
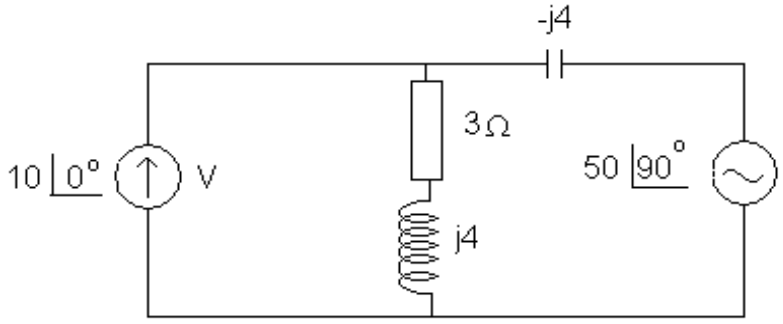


Fig Q(4a) (8marks)

b. Use superposition theorem to determine the voltage V in the network shown fig(4b)



Fig(4b) (5marks)

(c) In the network shown Fig 4(c) find the current through the load Z_L using Thevenin's theorem

$$Z_1 = (8 + j8)\Omega; \quad Z_2 = (8 - j8); \quad Z_3 = (2 + j20); \quad Z_L = -j10$$

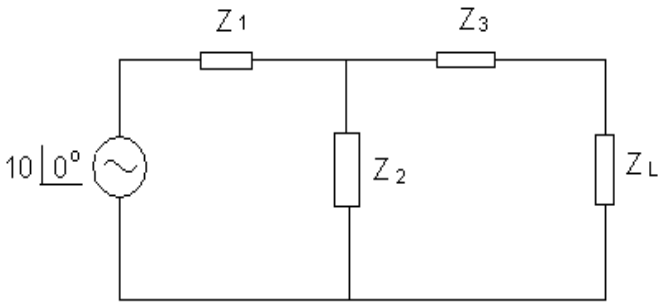


Fig.(4c) (5marks)

d) State the condition of duality of a circuit and give TWO examples dual quantities (2marks)

QUESTION FIVE.

a (i) With the aid of a diagram and waveforms describe how three phase supply a.c. voltages are generated

(ii)Describe two possible connections of three phase circuits and draw the phasor for each case (7marks)

b. A balanced star connected load is supplied from a symmetrical three phase 400V system. The current in each phase is 30A and lags 30 behind the phase voltage. Determine the:

i. Phase voltages
ii. Total voltage
iii. Draw the phasor diagram showing current and voltages (6marks)

c. Each phase of a star connected load consists of a resistance of 100 Ω in parallel with a capacitance of 31μF.Determine:

i. Line current
ii. Power absorbed
iii. Total KVA
iv. Power factor of the load when the load is connected to 415, 4wire,50Hz supply (7marks)