



# MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR FIRST TERM EXAMINATION FOR

DIPLOMA MODULE II ELECTRICAL

2601/204C, ELECTRICAL CIRCUIT ANALYSIS

DATE: 8/9/2021

TIME: 8:30 – 11:30 AM

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## INSTRUCTIONS:

Answer all questions

### QUESTION ONE

- a) i) Explain the function of the following parts of a D.C. machine
- I) Pole shoes
  - II) Armature core (4 marks)
- ii) A D.C. shunt motor is supplied with 230V with a current of 5A at 1000 rpm. The armature resistance and shunt are  $0.2\Omega$  and  $230\Omega$  respectively. The armature current is varied to 30A using rheostatic method. Calculate new speed. (5 marks)
- b) i) Explain the dynamic braking in d.c. machines (4 marks)
- ii) List the requirements of a good braking system (4 marks)
- c) Highlight any three areas of application of shunt wound D.C. motor. (3 marks)

### QUESTION TWO

- a) i) For figure 1 below determine the current through the  $5 + j6$  resistor using the Thevenin's theorem. (6 marks)

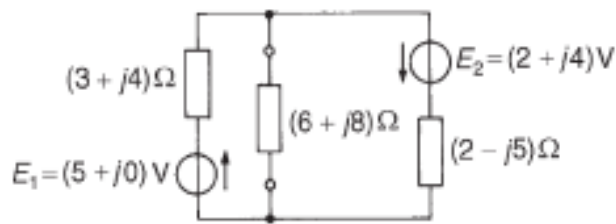


Figure 1

- ii) State the Nortons theorem (3 marks)
- b) For circuit in figure 2 below, using Delta-Star, transformation, determine the supply current. (7 marks)

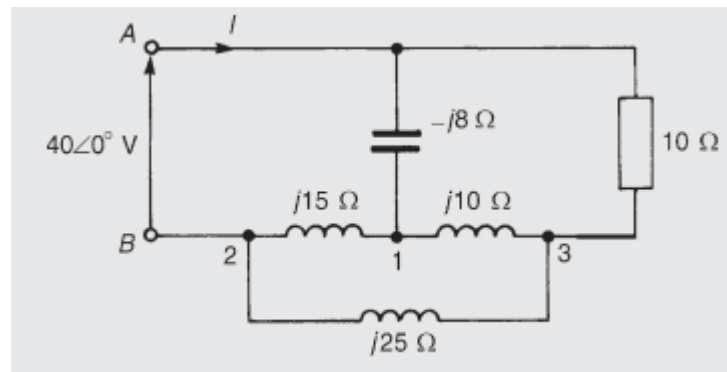


Figure2

- c) For the circuit shown in figure 3 below the load impedance  $Z$  is a pure resistance. Determine the value of  $R$  for maximum power to be transferred from the source to the load. (4 marks)

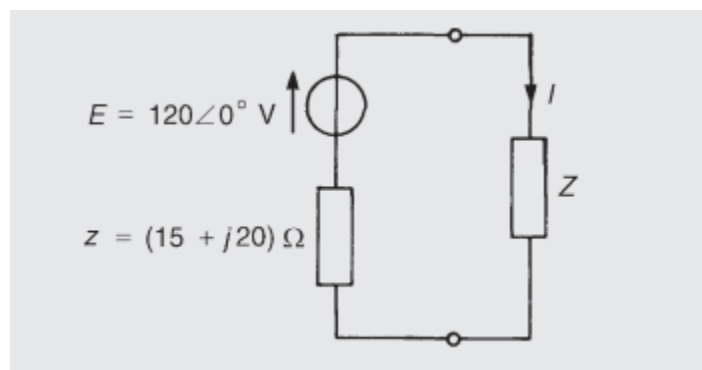


Figure 3

### QUESTION THREE

- a) i) Explain the terms D.C transients and Time constant as applied in transients. (4 marks)  
ii) Draw graphs of R.L growth circuit in transients (5 marks)
- b) The windings of a transformer have an inductance of 5H and a resistance of  $2\Omega$  connected to a 200V d.c. supply calculate.
- i) Steady state current flowing  
ii) Induced voltage after 0.15  
iii) Time for current to raise to 95% of its final value. (11marks)

### QUESTION FOUR

- a) i) Explain the terms harmonics and periodic time as applied to complex waves. (4 marks)  
ii) State any five sources of harmonies (5 marks)
- b) A supply voltage V is given by  
 $V = (300\sin 314t + 100\sin 942 t + 50\sin 1570t)V$   
It is applied to a circuit with resistance of  $15\Omega$  , in series to a coil of 10mH  
Determine
- i) Expression for instantenous current  
ii) rms current  
iii) rms voltage  
v) Power dissipated (11marks)

### QUESTION FIVE

- a) Define the following terms power factor and reactive power in A.C. circuit. (4 marks)
- b) A circuit has a resistor of  $30\Omega$  in series with an inductance of 0.2H. A 250V, 50Hz supply is connected. Determine
- i) Impedance  
ii) Current and phase angle  
iii) p.d. across the  $30\Omega$  resistor  
iv) p.d across the coil (8 marks)
- c) An A.C. network consists of a coil of inductance 80mH and resistance  $20\Omega$  in parallel with a capacitor of  $50\mu F$ . If the supply voltage is  $300V \angle 0^\circ$  at 50Hz supply. Determine
- i) Total circuit impedance  
ii) Supply current  
iii) Circuit phase angle  
iv) Current in capacitor (8 marks)