THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

DIPLOMA IN TECHNOLOGY

DCSE IV

EEC 2209

CIRCUIT AND NETWORK ANALYSIS IV

SEMESTER IV EXAMINATIONS

SERIES: FEBRUARY 2011 SERIES

TIME: 2 HOURS

Instructions to Candidates:

1. You are required to have the following for this examination;
   - Answer booklet
   - Non-programmable calculator

2. Attempt Question **ONE** and any other **TWO** Questions.

(COMPULSORY)

Question ONE

a) State the maximum power transfer theorem in Alternating current network analysis. (2 marks)

b) The circuit of Figure 1 has a load impedance whose power factor is 0.8 lagging when connected across across terminals A and B in order to draw the maximum power from the source. Determine:

i) the load impedance
ii) the total circuit impedance
iii) the power developed in the load
iv) the power loss in the source. (8 marks)

Fig 1

c) A single – phase transformer has 500 turns on the primary and 40 turns on the secondary winding. The mean length of the magnetic path in the iron core is 150cm and the joints are equivalent to an airgap of 0.1mm. When a p.d. of 3000v is applied to the primary, maximum flux density is 1.2wb/m^2. Calculate:

i) the cross-sectional area of the core
ii) No load secondary voltage
iii) No load current drawn by the primary
iv) power factor on no load

Given that AT/cm for a flux density of 1.2 wb/m^2 in iron to be 5, the corresponding iron loss to be 2 watt/kg t 50Hz and the density of iron as 7.8 gram/cm^3. (16marks)

d) State the TWO main tests carried out to describe the performance of a transformer. (4 marks)

(ANSWER ANY OTHER TWO QUESTIONS)

Question TWO

a) State the following theorems as applied in alternating current networks:
   i) Norton's
   ii) Millman's (4 marks)

b) For the network show in Figure 2, determine using Therenin's theorem, the voltage across capacitor. (16marks)

Figure 2

Question THREE

a) State the significance of Bank emf in a Dc motor. (2 marks)

b) A 25KW, 250V dc shunt generator has armature and field resistances of 0.06Ω and 100Ω respectively. Determine the total armature power developed when working:
   i) As a generator delivering 25KW output
   ii) As a motor taking 25 KW input.

c) i) Explain why a series motor should never be started without some mechanical (not belt driven) load. (4 marks)

Question FOUR

a) Define the following:
   i) Harmonics
   ii) Complex waveforms (4 marks)

b) A voltage $e = 250\sin wt + 50\sin\left(3wt + \frac{\pi}{3}\right) + 20\sin\left(5wt + \frac{5\pi}{6}\right)$ is applied to a series circuit of resistance 20Ω and inductive 0.05H. Derive

i) An expression for the current
ii) The RMS value of the current
iii) The RMS value for the voltage
iv) The total power supplied and
v) Power factor.

Take w = 314 rad/s (16marks)

Question FIVE

With the aid of labelled diagrams, describe briefly the following types of alternating current filter networks.

i) Low-Pass RC filter
ii) High-Pass RC filter
iii) RC Bandpass filter
iv) RC Bandstop filter. (20marks)