10

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST)

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATIONS

FOR

DIPLOMA IN MECHANICAL AND INDUSTRIAL ENGINEERING

COURSE CODE: **DME 066**

COURSE TITLE: **ELECTRICAL ENGINEERING PRINCIPLES II**

DATE: 21/04/2022 **TIME: 12:00-2:00 PM**

Instructions to candidates

1. This paper contains FOUR questions
2. **Question one** is **compulsory** and carries 30 marks
3. Attempt any other Two questions
4. Question 2, 3,4 each carry 20 marks

QUESTION 1 (compulsory) [30 mks]

a). Show that for a series resonant circuit, the resonant frequency is given by the following expression.

$$F_o = 1/(2\pi)\sqrt{\left(\frac{1}{LC}\right)}$$ [7mk]

b). Explain the conditions for which the formula for parallel resonance reduces to the one in (a) above . [3 mk]

c) A three phase motor operating off 400V system is developing 20kw at an efficiency of 0.87 p.u and power factor of 0.82. Calculate;

i) line current [5mk]

ii) Phase current if the windings are delta connected. [2mk]

d) Three similar non-inductive resistors are connected in star to 415V, three phase supply. If the line current of 6A flows, calculate

i. The value of each resistor [2mk]

ii. The phase power [2mk]

iii. Total power consumed. [2mk]

e) A star connected three phase winding has a resistance of 50Ω per phase and is connected to a 415V, 3-phase supply. Calculate the phase and line currents. [4mk]

f) Draw the diagrams for the following three phase windings clearly showing the relationship between line and phase parameters;

i) Star connection [1.5mk]

ii)Delta connection [1.5mk]

QUESTION 2

a) Show that complex impedance is given by;

$Z = R + j(2\pi fl - (1/(2\pi fc))$ [5mk]

b) In R-L-C series circuit $R = 15\Omega$, $X_L = 100\ \Omega$ and $X_C = 120\ \Omega$ .The voltage of supply is 200V. Calculate;

i. The impedance in polar form [2 mk]

ii The current [2 mk]

iii. The phasor diagram. [1 mk]

b) An electrical device takes 5 KVA at p.f of 0.7 lagging from a 400V, 50HZ.

c) Supply. Determine;

i) Phasor diagram [1mk]

ii) useless power [3mk]

iii) Power dissipation [3mk]

iv) Current and its active and reactive components [3mk]

QUESTION 3

a) Explain the meaning of an electric filter. [2mk]

b) State FOUR characteristics of a salient electric filter. [4mk]

c) Using sketches differentiate between the one port and two port networks. [4mk]

d) i. state Thevenin theorem. [2mk]

ii. Determine and sketch the equivalent Norton's Generator given that;

$E_T = 20v < -20°$

$Z_T = 5k\Omega < 45°$ [4mk]

iii. . Determine and sketch the equivalent Thevenin Generator given that;

$I_N = 4mA < -65^0$ $Z_N = 5k\Omega < 45°$

[4mk]

QUESTION 4

a) An R-C circuit consisting of 10.7μF capacitor in series with 150Ω resistor is connected to 250v, 50Hz supply. Determine:

i. The current [6mk]

ii. The power factor [3mk]

iii. The reactive power [3mk]

b) List three requirements of a balanced three phase set. [3mk]

c) Assuming a star connected three phase winding, relate the line and phase voltages and currents and hence show that the total power in a three phase system is given by:

$p = 1.732\ V_L I_L \cos \phi$ [5mk]