



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

MECHANICAL & AUTOMOTIVE ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG2305: WORKSHOP PROCESSES AND PRACTICE IV

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2017(SCHOOL BASED)

TIME: 2 HOURS

DATE: JULY 2017

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)

- i. Identify the FOUR key Stages in electrical documentation process
- ii. Describe major activities in each stage above

(8 Marks)

b)

- i. Explain any FOUR advantages of Underground Wiring System compared to Overhead Wiring System
- ii. State any FOUR unique applications of air as a suitable electrical insulator

(8 Marks)

c)

- i. State any TWO advantages of Impedance Bridges when used in electrical measurements as opposed to direct measurements

ii. The AC Bridge in circuit Fig Q1 below was used in measurement of Capacitance

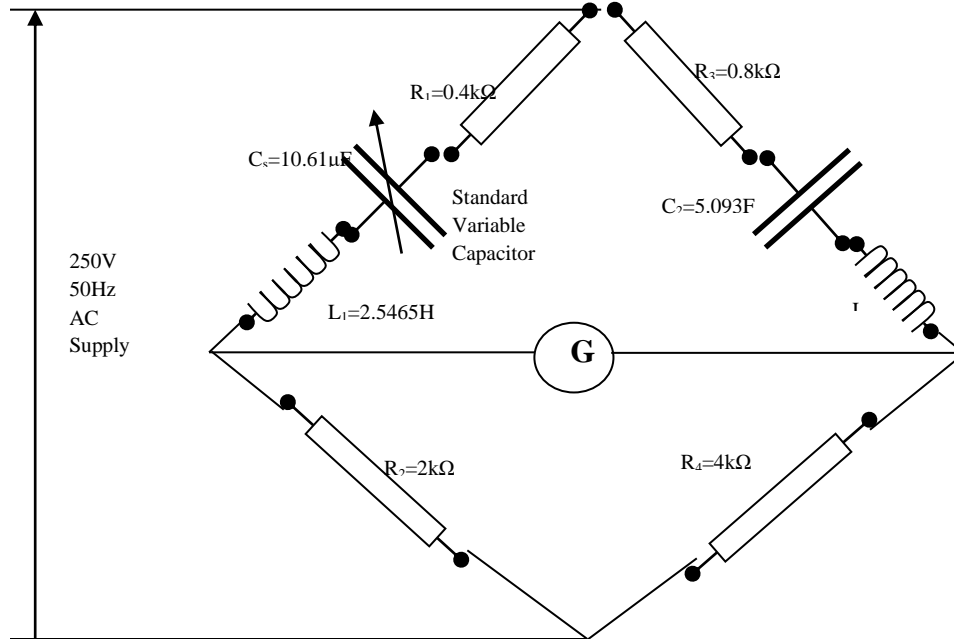


Fig Q1

Given that the value of standard inductor used indicated 10.61H as shown above at null condition, determine the value of unknown inductor value L_x (7 Marks)

d)

- i. Distinguish between Fusion Connections and Pressure Connections in Electrical jointing
- ii. Identify THREE types of fusion connections in Electrical Jointing
- iii. State ONE weakness for each of the joint made in the above fusion connections (7 Marks)

Question TWO

a)

- i. Explain the effect of the following to current intake by induction machines during starting
 - I. Inertia of rotating masses
 - II. Magnetizing Current
 - III. Frictional Losses
 - ii. Explain the relationship between current intake and rotor inertia when an induction machine is suddenly reversing. (4 Marks)
- b) Stator and rotor parameters of a single phase, 240V, 50Hz, 5% slip, Induction Motor connected with a Variable Frequency Drive are: $R_s=1.5\Omega$, $L_s=7.958\text{mH}$, $R_r'=1\Omega$, and $L_r'=4.456\text{mH}$. If the current due to inertia and magnetizing currents are 0.6 and 8 times the running current respectively, estimate the total starting currents (8 Marks)

- c) Sketch power and control circuit of a Star-Delta starter and explain how contactors are coordinated (8 Marks)

Question THREE

- a)
- i. Explain the causes of the following errors in an instrument
Zero Setting Error
Hysteresis Error
Parallax error
 - ii. A 4-20mA standard current sensor is applied together with a 4-bit Analog to Digital converter. Determine the digital output corresponding to 13mA (7 Marks)
- b)
- i. Sketch a Moving Iron Instrument and label important parts
 - ii. The MI instrument above having a 3V internal battery is used for measurement of resistance. A deflection of 1.5° was observed for $0.2K\Omega$ resistance measured. Calculate the deflection observed and the corresponding resistance if 10mA sensor current flowed. (7 Marks)
- c) A 2000:1 Current Transformer and 1:96 Voltage Transformer are used to obtain instrument level Currents and Voltage to operate protection system of a 3-phase 415V, 40A Induction Motor. Draw the circuit and calculate the output Current, Voltage and Power of the secondary side of instrument transformers. (6 Marks)

Question FOUR

- a)
- i. List the workshop tools and materials required before commencing Etching in an electronic workshop
 - ii. Describe the Wet Etching Process for creating electronic circuits. (10 Marks)
- b) Read the Electrical Plan Fig Q4 below and answer questions that follow:
- i. Describe the structural layout of premise including possible extensions.
 - ii. State the likely uses of the premise
 - iii. Describe the electrical plan
 - iv. Identify the parts of electrical system in place
 - v. State other parts of electrical system missing from the observed plan

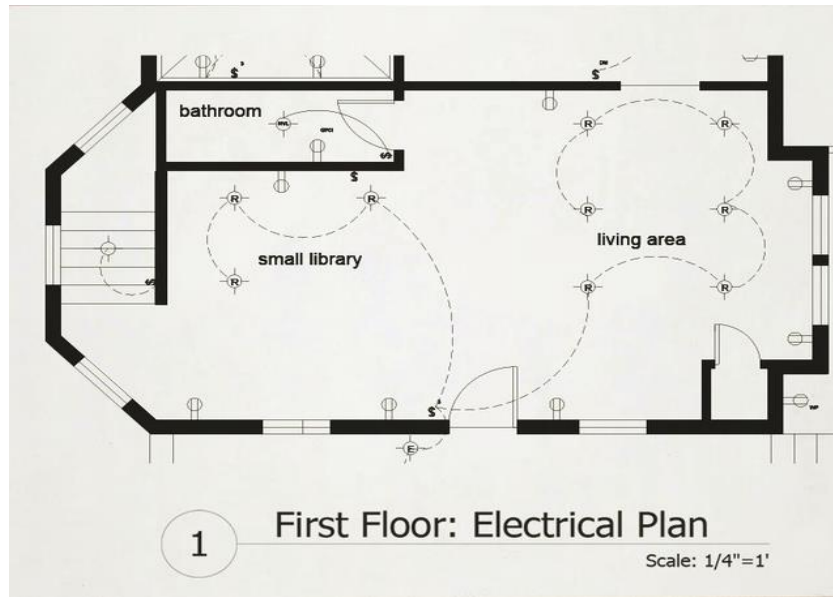


Fig Q4

(10 Marks)

Question FIVE

a) Explain the following terms in electrical installation:

Over current protection

Switch Gear

Isolation

(3marks)

b) Sketch the typical main and distribution circuits in a domestic installation (4 Marks)

c) A 415 V, 50 Hz three-phase motor with an output of 10Hp, power factor 0.8 and efficiency 85% is to be wired using 500 V light duty three-core mineral insulated p.v.c. sheathed cable. The length of run from the HBC protecting fuses is 20m. Taking the Grouping, Thermal Insulation and Ambient temperature correction factors of 0.82, 0.90 and 0.51 respectively, and the cable volt drop to be 15mV/A/m.

- i. Select through calculations the cross-sectional area of the required cable from the table below
- ii. Calculate the Terminal Voltage for the boiler and verify suitability of cable size selected
- iii. Sketch the circuit for the above
- iv. List all accessories required for the installation

CSA	Cable Rating(A)	Volt drop(V/A/m)
4.0mm ²	25A	25mV/A/m
6.0mm ²	45A	18mV/A/m
10.0mm ²	90A	12mV/A/m

Table Q

(13 Marks)