



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

ELECTRICAL ENGINEERING DEPARTMENT

## UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG2305: WORKSHOP PROCESS AND PRACTICE IV

## END OF SEMESTER EXAMINATION

**SERIES: MAY 2016**

**TIME: 2 HOURS**

**DATE:** Pick Date Select Month Pick Year

### 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.**

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### Question ONE (Compulsory 30 marks)

a)

- i. With the aid of sketches show the appearance of THREE types of conduit bends
- ii. Explain the procedure of bending a PVC conduit
- iii. List any THREE terminal accessories associated with conduits

**(9 Marks)**

b)

- i. Explain the purpose of overcurrent protection devices, switchgears and isolators in an electrical installation:
- ii. Sketch the typical arrangement for intake and final circuits in a domestic installation having many units.

**(8 Marks)**

- a) A 415 V, 50 Hz three-phase motor with an output of 7.5 kW, power factor 0.8 and efficiency 85% is to be installed. Taking the Grouping, Thermal Insulation and Ambient temperature correction factors of 0.44, 0.38 and 0.51 respectively, and the cable volt drop to be 15mV/A/m. given that cross-sectional area and cable ratings are as shown in Table 1 below:

c)

| Cable Size(mm <sup>2</sup> ) | Rating(A) | Volt Drop(mV/A/m) |
|------------------------------|-----------|-------------------|
| 4                            | 20        | 26                |
| 6                            | 30        | 12                |
| 10                           | 80        | 7                 |

**Table 1**

- i. Select through calculations and table above the cross-sectional area of the required cable
- ii. Determine the maximum possible length of the cable
- iii. Sketch the circuit for the above system from the distribution board intake
- iv. List all accessories required for the installation

**(13 Marks)**

**Question TWO**

a)

- i. Explain any FOUR disadvantages of underground wiring system as compared to exposed aerial systems.
- ii. State FOUR special conditions which require air as a suitable electrical insulator

**(8 Marks)**

b) Sketch a twin-with-earth PVC sheathed and insulated cable and explain the function of each part

**(5 Marks)**

c)

- i. Explain THREE possible methods of measuring frequency
- ii. The AC Bridge in circuit Fig Q1 below was used in measurement of Capacitance

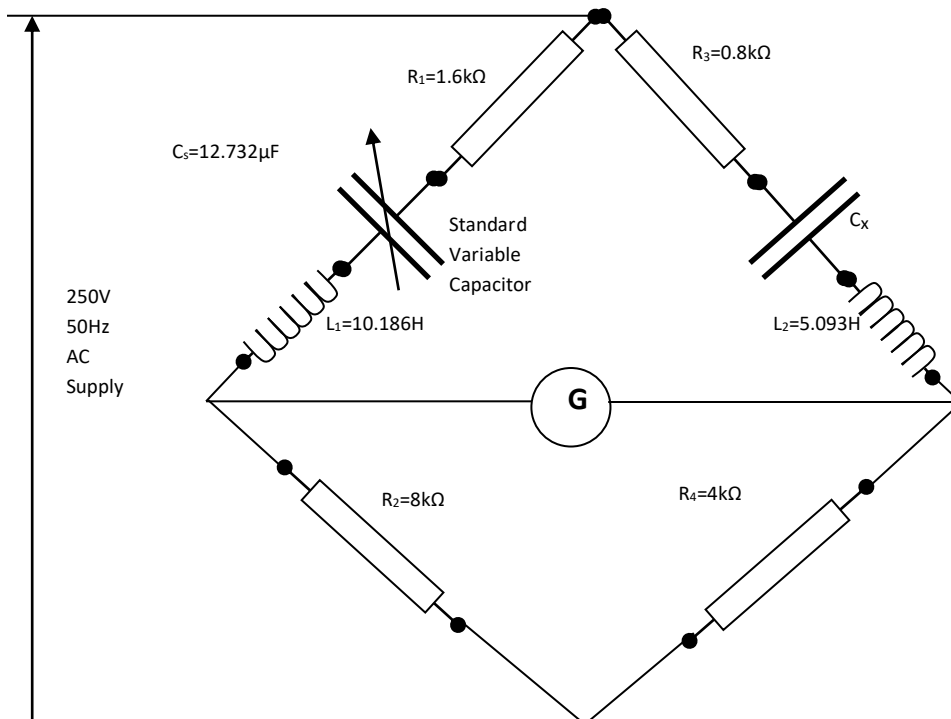


Fig Q1

Given that the value of standard capacitor used indicated  $12.732\mu\text{F}$  as shown above at null condition, determine the value of unknown capacitor value  $C_x$

**(7 Marks)**

### Question THREE

a)

- i. Explain TWO reasons why the starting current for induction machines is high.
- 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, 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  $L_r'=1.3263\text{Mh}$ , slip = 5% . Estimate the starting currents for 50Hz and 40Hz operation respectively given that it is estimated to be 6 times higher than running current.

**(6 Marks)**

- c) Sketch power and control circuit of a Star-Delta starter and explain how it functions

**(10 Marks)**

### Question FOUR

a)

- i. State the general procedure of connecting an instrument for voltage and current measurement in the workshop
- ii. Explain the causes of Zero Setting Error, Hysteresis Error and Parallax error in instruments

**(6 Marks)**

- b) Sketch a Moving Iron Instrument and explain how it works.

**(4 Marks)**

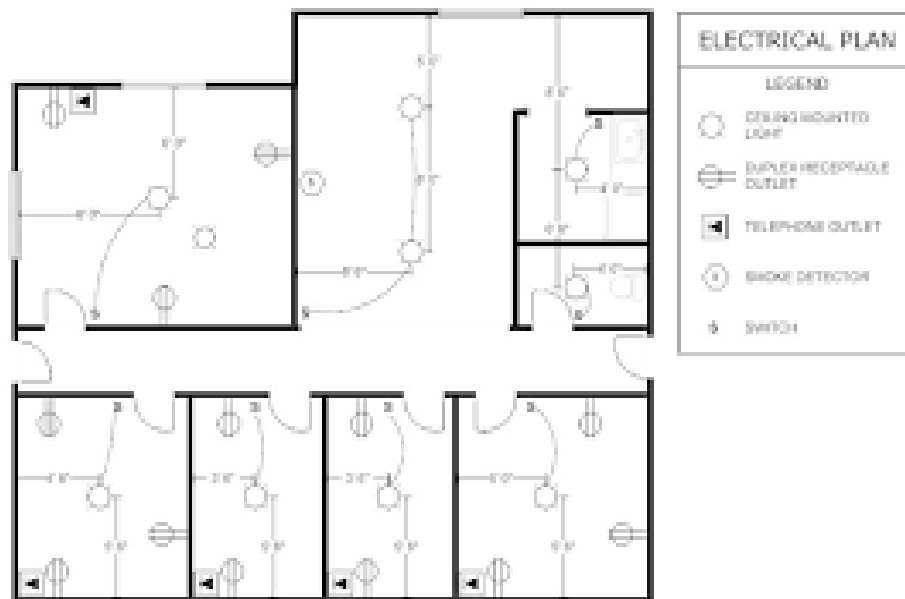
- c) 2000:1 Current Transformer and 1:96 Voltage Transformer are used to obtain instrument level currents and voltage to operate protection system of a 3-phase 415V, 40A Induction Motor.

- i. Draw the circuit arrangement for the above
- ii. Find the value of series and shunt resistances required at the outputs of the transformers so that a 0-5V and 4-20mA standard current sensor are used
- iii. If a 8-bit Analog to Digital converter is connected to the outputs of the sensors, determine the digital output corresponding to 2.52V and 16mA respectively
- iv. An electrodynamic wattmeter with maximum deflection of  $90^\circ$  is used directly with the instrument transformers for power measurement, determine the deflection corresponding to 30A motor current.

**(10 Marks)**

## Question FIVE

- a)
- Distinguish between Fusion Connections and pressure Connections in Electrical jointing
  - Identify THREE types of fusion connections in Electrical Jointing
  - State ONE weakness for each of the joint made in the above fusion connections
- (7 Marks)**
- b)
- List the workshop tools and materials required before commencing Etching in an electronic workshop
  - Describe the Etching Procedure for creating electronic circuits.
- (7 Marks)**
- c) Read the electrical layout plan Figure 1 below and answer the questions that follow:



**Figure 1**

- Suggest the possible purpose of the plan
- Identify the parts of electrical system included in the plan
- Highlight factors considered while positioning access points
- Describe the types of receptacles proposed in the plan

**(6 Marks)**