



TECHNICAL UNIVERSITY OF MOMBASA

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.

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 voltage 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 ²) | 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

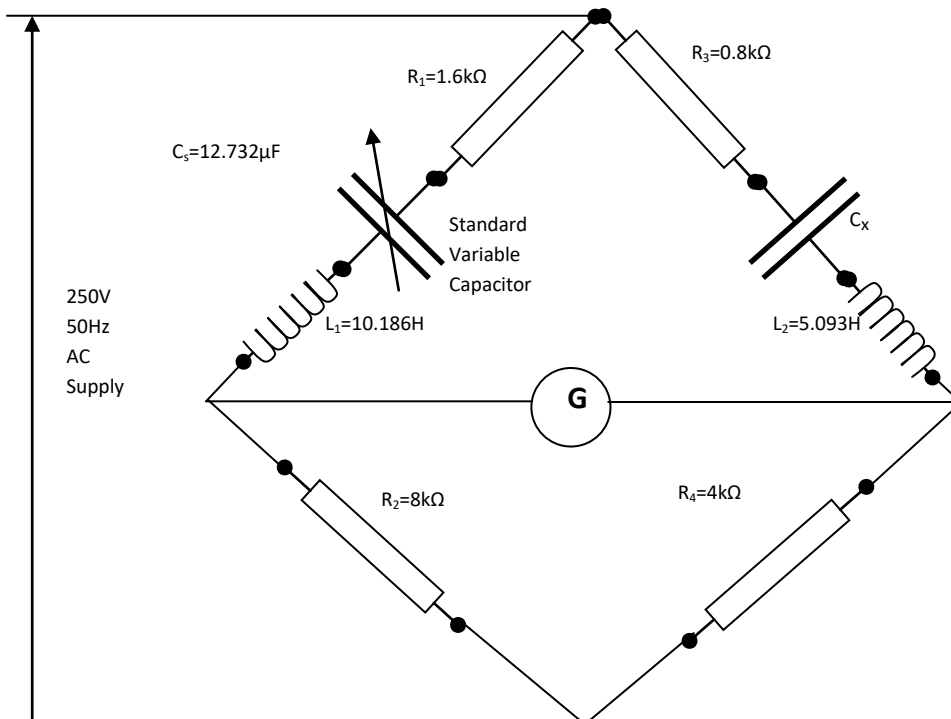


Fig Q1

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° 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:

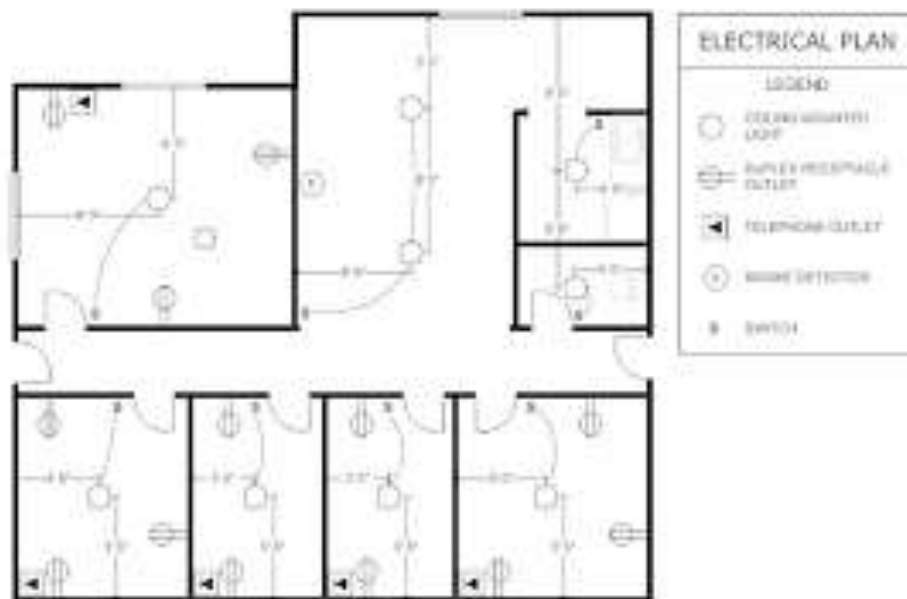


Figure 1

- 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)