



# TECHNICAL UNIVERSITY OF MOMBASA

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Engineering

Mechanical Department

## UNIVERSITY EXAMINATION FOR:

EMG2305: WORKSHOP PROCESSES AND PRACTICE

END OF SEMESTER EXAMINATION

**SERIES: SEPT 2017**

**TIME: 2 HOURS**

**DATE:** August 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.**

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### Question ONE (Compulsory 30 marks)

1 (a) (i) Define power factor and explain how its improvement benefits a utility company and the consumer.

(ii) With aid of a sketch describe how a capacitor can be used to improve the power factor of a three phase induction motor.

(iii) An industrial plant is operating at 650KW, and maximum demand of 890 KVA. The facility has a power base KVA demand charges which shall reduce as the power factor is improved. The demand charges rates have been fixed at ksh 55 per month per KVA. Determine the savings possible by improving the power factor along with payback period of putting any investment on power factor correction, given the best power factor as 95%. Take capacitor multiplying factor as 0.5 and the cost of a 325KVar capacitor on 415V is ksh85/KVar. **(8mks)**

(b) Sketch the symbols of the following motor starter equipments and describe their operation

(i) Normally open and normally closed contacts

(ii) Coils

(iii) Overload relays **(6mks)**

(c) An industry requires direct on line forward and reverse method for its motors

(i) Draw the power circuit and control circuits for this method

(ii) State TWO IEE regulations in regards to motors starters.

(iii) Describe briefly the principle of operation of circuit (i) and state the purpose of overload relay **(8mks)**

(d) (i) State TWO precautions to be observed during soldering process

(ii) Explain the need of a flux during soldering process and describe the TINNING process during soldering.

(iii) Describe the soldering procedure and characteristics of a good and a cold solder joint **(8mks)**

### **Question TWO**

Qn2 (a)(i) Define a final sub circuit and state regulation 27(a)(i) which governs final sub circuit

(ii) State the any THREE types of final sub circuits

(iii) With aid of a sketch illustrate different methods of connecting distribution fuse board. **(6mks)**

(b) Draw symbols of the following electrical installation equipments

(i) Consumer control unit

(ii) Distribution board

(iii) Intermediate switch

(iv) Switched socket outlet **(4mks)**

(c) Draw circuit diagrams of the following

(i) Three lamps controlled by two 2 way switches and one way switch, the one way switch acts as a master switch

(ii) Control of two lamps from two positions

(iii) Control of three lamps from four positions

(d) An installation is to be carried out using steel class B steel conduit system. It consists of the following final sub circuits.

four socket outlets three wired in ring and one a spar, lighting circuit made of 4 Lamps. The lamps are controlled by three two way switches X, Y AND Z. Switch Y acts as a slave of switch X and Z and

one position it switches lamps 1 and 2 and at the other position it switches lamps 3 and 4, a cooker control unit, and a water heater unit.

- (i) List the material, tools and accessories required for the installation
- (ii) Draw the wiring circuit diagram for the installation
- (iii) List the sequence to be followed in order to complete the installation **(10mks)**

### Question THREE

Qn3 (a) (i) Describe the need of a starter for a 3 phase induction motor.

(ii) Show that  $\frac{T_{st}}{T_f} = K^2 \left[ \frac{I_{sc}}{I_f} \right]^2 \times S_f$  for autotransformer starting method and state TWO advantages of and application of this method

(iii) Determine the approximate starting torque of an induction motor of full load torque when started by means of star-delta and an autotransformer with 50% tapping. The short circuit current of the motor at normal voltage is five times the full load current and full load slip is 5%. Neglect magnetizing current **(10mks)**

(b) For the following three phase induction motor faults state possible causes and remedies.

- (i) Overheating of a motor once loaded
- (ii) Motor speed falls sharply after loading
- (iii) Motor after loading, fuse blowing, fails to restart due to trip-off of automatic switch
- (iv) Motor loaded after start bearing overheating **(10mks)**
- (v) Motor fails to start without load, fuse blowing, switch trip off, slow start with electromagnetic noise

### Question FOUR (10mks)

4(a) with aid of a sketch describe the construction and principle of operation of the following electronics components

- (i) A capacitor
- (ii) A transistor
- (iii) 555 timer **(7mks)**

(b) (i) Define a transducer

(ii) With aid of a circuit diagram describe the construction and principle of operation of a speaker **(4mks)**

(C) A light sensitive Alarm project is to be implemented

(i) List the material required for the project

(ii) Describe the soldering system you require

(iii) Explain how you will prepare your work piece for soldering

(IV) Describe the de-soldering process **(10mks)**

#### **Question FIVE**

(a) (i) List the equipments needed for threading a 20mm steel conduit

(ii) Explain the need of coolant oil during threading

(iii) Describe the process of cutting threads on a 20mm conduit **(7mks)**

(b) Start the equipment to be used for the following processes

(i) Cutting a PVC conduit

(ii) Bending a PVC conduit

(iii) Bending class B steel conduit.**(3mks)**

(C) Describe the following wiring accessories stating construction and application

(i) Lamp holders

(ii) Consumer control unit

(iii) Lamp holders

(d)(i) State disadvantages of rewirable fuse

(ii) With aid of a diagram describe the construction of HBC fuse and state TWO of its advantages **(10mks)**