



TECHNICAL UNIVERISTRY OF MOMBASA

# Faculty of Engineering & Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEPE 6)  
(EVE/REG)

**EEP 2307: HEATING, REFRIGERATION & AIR CONDITIONING**

END OF SEMESTER EXAMINATION

**SERIES: DECEMBER 2014**

**TIME: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any **THREE** questions  
Maximum marks for each part of a question are as shown  
This paper consists of **THREE** printed pages

### Question One

- a) A cubic water tank has surface area of 60m<sup>2</sup> and filled to 90% capacity six time daily. There is heat from 20°C to 65°C. The losses per square metre of tank surface per 1oC temperature difference are 6.3W. Find the loading in Kw and the efficiency of the tank. Assume the specific heat of water to be 4200jkg and kwh of 3.6MJ **(10 marks)**
- b) State any **FOUR** disadvantages of core-type induction heating process. **(4 marks)**  
Explain the following terms used in Eddy current:  
(i) Surface harding  
(ii) Annealing  
(iii) Soldering **(6 marks)**

### Question Two

- a) State any **THREE** factors considered when selecting a welding process. **(3 marks)**
- b) State any **FOUR** advantages of using coated electrodes in welding processes **(4 marks)**
- A 30kw-400v resistance oven is to employ a nickel-chrome strip 0.245mm thick for the three star-connected heating elements. If the wire temperature is to be 1,100°C and the charge temperature is 700°C calculate a suitable width for the strip. Assume the emissivity = 0.9 and radiating efficiency to be 0.5 and resistivity of the strip material is 101.6 x 10Ω<sup>-8</sup>-m with the aid of a diagram explain the operation of a direct Arc furnace **(5 marks)**

### Question Three

- a) Distinguish the following methods of heat transfer. Give an example for each:  
(i) Conduction  
(ii) Convection  
(iii) Radiation **(6 marks)**
- b) State: (i) Any **THREE** application of electric heating  
(ii) **FOUR** advantages of electric heating **(7 marks)**
- c) In the design of heating system show that the dimensions for an heating element are given by:  
$$\frac{d}{l^2} = \frac{4IH}{v^2}$$
 **(7 marks)**

### Question Four

- a) State any **FOUR** properties of a good refrigerant. **(4 marks)**
- b) (i) With the aid of a well labeled diagram explain the operation of an absorption type refrigeration system. **(8 marks)**  
(ii) State any **TWO** types of compressors used in refrigeration. **(2 marks)**

- c) Explain any THREE applications of Air conditioning and refrigeration in the industry.  
(6 marks)

### Question Five

- a) State any TWO advantage of Eddy-current heating. (2 marks)
- b) Explain any FOUR factors which determine the heat development in an induction heating system. (8 marks)
- c) A low frequency induction furnace whose secondary voltage of 20v is maintained constant at 10V takes 400kw at 0.6p.f when the hearth is full. Assuming the resistance of the secondary circuit vary inversely as the height of the charge and the reactance to remain constant. Calculate the height up to which the hearth should be filled to obtain maximum heat. (10 marks)