



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

EEP2307 : HEATING, AIRCONDITIONING, REFRIGERATION & VENTILATION

END OF SEMESTER EXAMINATION

SERIES: NOVEMBER 2024

TIME: 2 HOURS

DATE: NOVEMBER 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt **ANY THREE** Questions

Do not write on the question paper.

Question ONE

- a) (i) State the factors affecting induction heating (2marks)
- (ii) With the aid of sketches explain the operation of eddy current heating (6marks)
- b) (i) Derive the expression of the power developed in induction heating per square meter of area πdl entering a metallic of a cylindrical work piece, (6marks)
- (ii) A brass tube 40cm long is placed within a coil It has 30 turns and carries 200A at a frequency of 600kHz. If brass has a resistivity of 6.4×10^{-8} determine:-
- I Depth of heating
- II Heat per unit area (6 marks)

Question TWO

- (a) Define the following as used in air-conditioning systems
- (i) Seasonal energy efficiency ratio (SEER)
- (ii) Refrigeration Unit
- (iii) British Thermal Unit (BTU) as explained in SI metric system (6marks)

- (b) Describe the following Whole-House Ventilation
- (i) Exhaust ventilation systems
 - (ii) Balanced ventilation systems
 - (iii) Energy recovery ventilation systems
- (6marks)**
- (c) Briefly explain the following air conditioning systems
- (i) Portable evaporative system
 - (ii) Central air-conditioning unit
- (8marks)**

Question THREE

- (a) Explain any **THREE** applications of dielectric heating **(3marks)**
- (b) Derive the expression of power loss per unit volume in dielectric heating **(5marks)**
- (c) A dielectric heating unit is to operate from a 40Kw source at 7.5MHz. The material is square sheet having 30cm side by 1cm thickness. If the dielectric constant is 5.9, what voltage must be applied to these electrodes if the $P_f=5\%$
- Take $\epsilon_0 = 8.85 \times 10^{-12}$ **(6marks)**
- (d) With the aid of sketches explain how a given workpiece is heated by use of dielectric heating **(6marks)**

Question FOUR

- (d) For a given room explain how to work out the correct BTU size of an air conditioning unit **(6marks)**
- (e) Explain the purpose of compressor reed valves and why they should be firmly seated in Refrigeration system **(4marks)**
- (f) Explain the following in refrigeration system
- (i) flooding of the condenser coils
 - (ii) Purpose of Condenser
- (4marks)**
- (g) Describe the operation of the following expansion valves in airconditioning system
- (i) Internally-equalized valve
 - (ii) Externally-equalized valve
- (6marks)**

Question FIVE

- (a) Explain FOUR factors and parameters that affect the performance and use of a typical heating element, **(6marks)**
- (b) State Stefan's Law of heat dissipation and explain all the parameters **(4marks)**
- (c) A resistance oven employing nichrome wire is to be operated from a 240V single phase supply and to be rated at 10kw. If the temperature of the element is to be limited to 840°C and the average temperature of the charge is 500°C and given $\eta = 0.6$, emissivity = 0.9 and $\rho = 1.016 \times 10^{-6}$ Calculate:
- (i) The width
 - (ii) The length of element
- (7marks)**
- (d) List any THREE industrial applications of resistance heating elements **(3marks)**