UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	THERMAL ENVIRONMENTAL DESIGN
COURSE CODE	:	BDE 40903
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS **ONLY** **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Figure **Q1(a)** shows the acceptable operative temperature for naturally conditioned space according to ASHRAE 55-2013. Distinguish the methodology to determine the indoor operative temperature and prevailing mean outdoor temperature for the acceptable operative temperature for naturally conditioned space.

(8 marks)

(b) Interpret these three categories of adaptive thermal comfort with proper elaboration and examples.

(i) Physiological adaptation;

(ii) Behavioral adaptation; and

(iii) Psychological adaptation.

(12 marks)

Q2 (a) The Predicted Mean Vote (PMV) model of thermal comfort created by Fanger in the late 1960s is used worldwide to assess thermal comfort.

(i) Describe briefly about PMV model; and
(ii) Criticize the PMV model based on its precision to predict thermal comfort.

(12 marks)

(b) There may be insufficient opportunity for adaptive action to be fully effective. It may be constrained by several factors. Elaborate the related constraints in execution of effective adaptive thermal comfort with examples.

(8 marks)

Q3 (a) Describe and give example for heat acclimatization process.

(8 marks)

(b) A mechanic is working on mobile diesel equipment in the field away from the workshop. The task involves servicing the diesel engine, a process which takes about two hours, and is normally done at the start of each shift. In this case the worker commences his task at 2 pm which is the hottest part of the day. Some surfaces (exhaust, engine, etc.) are hot to touch and the process involves moderate work such as climbing and descending to gain access to components.

The work site is situated about two km from the workshop. The mechanic is acclimatized and had attended a training session on thermal stress. He is wearing a single layer long shirt and trousers and a respirator is not required.

There is a light breeze and the WBGT has been measured at 26.9^{O}C. Using the screening criteria in Malaysian Guideline of Heat Stress Management in Workplace 2016, evaluate the potential risk of heat stress to the mechanic and provide the suitable administrative control to avoid heat induced illness.

(12 marks)

Q4 (a) Describe activities involved in walk-through inspection in Indoor Air Quality (IAQ) investigation.

(10 marks)

(b) According to ASHRAE 26.1: Ventilation for Acceptable Indoor Air Quality, examine the criteria each agency used in adopting its guideline values for indoor contaminants such as;

(i) Occupational Safety and Health Administration.(OSHA),
(ii) National Institutes of Safety and Health (NIOSH),
(iii) World Health Organization.(WHO),
(iv) American Conference of Governmental Industrial Hygienists (ACGIH), and
(v) National Ambient Air Quality Standards (NAAQS).

(10 marks)

Q5 (a) You had been hired as the heat stress assessor for the commercial kitchen in a hotel. Most of the workers of the kitchen were foreign workers and worked in the kitchen daily from 5.00 am until 9.00 pm. The hotel management, received an employee complaint regarding heat stress in the cooking section. The complaint alleged that employees were working in hot temperature cause by the radiant heat of the industrial stove and industrial oven during cooking and baking process. They felt dehydrated, the temperature may have affected an employee's breathing, an employee was sent to the emergency room for heat exhaustion, and the conditions were unworkable. As the heat stress assessor, propose heat stress investigation that will be carried out to the hotel management with appropriate elaboration.

(12 marks)

(b) Before any heat stress measurement is carried out as part of monitoring the condition of workplace, we should identify the hazard and evaluate the risk through screening checklist. Select the important parameters that should be included in the screening checklist with appropriate elaboration.

(8 marks)

Q6 (a) You have been hired as an indoor air quality assessor for an automotive service centre in Batu Pahat. The workers of the automotive service centre works in a semi air-conditioned environment. However, the office workers often complained of dizziness, headache, nausea and eye irritations.

(i) As the indoor air quality assessor, construct a flowchart for indoor air quality investigation and assessment that you will conduct.

(10 marks)

(ii) Propose several solutions on improving the indoor air quality in the workplace based on the possible indoor pollutants exists in the investigated workplace.

(10 marks)

- END OF QUESTION -

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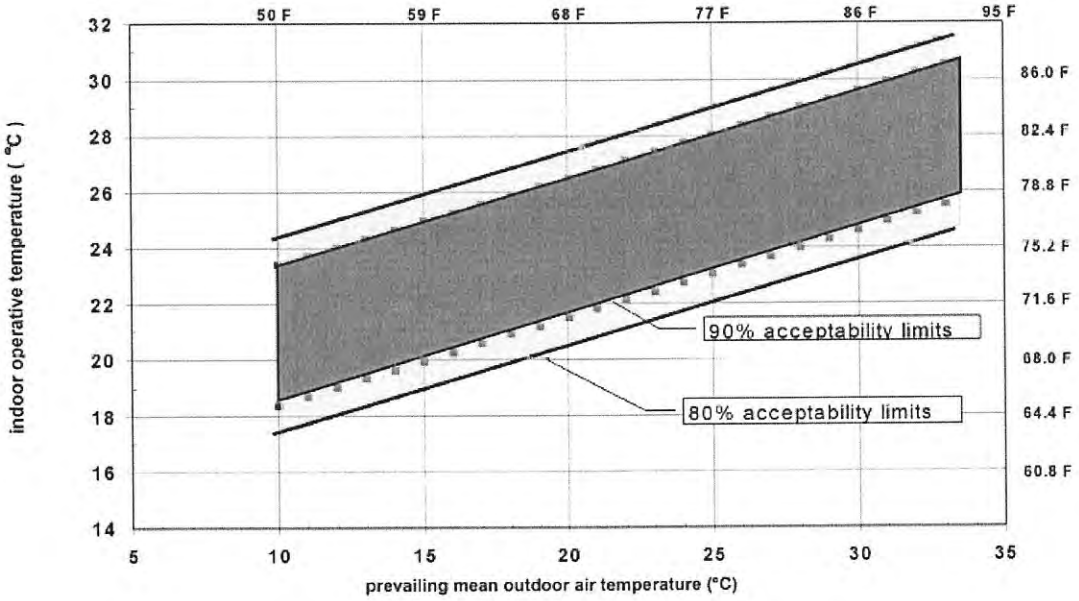

Figure Q1(a)