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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER 1
SESSION 2020/2021**

COURSE NAME : THERMAL ENVIRONMENTAL DESIGN
COURSE CODE : BDE 40903
PROGRAMME CODE : BDD
EXAMINATION DATE : JANUARY/ FEBRUARY 2021
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1**
- (a) Compare the research contribution in thermal comfort by A.P Gagge in 1930s and P.O Fanger in 1960s.
(8 marks)
- (b) 'PMV/PPD model underestimates the adaptive capacity of the human population. The adaptive model does not fit easily into the current ways of expressing standards for thermal comfort.'
Support the above statements by referring to ASHRAE 55-2013 standard.
(8 marks)
- (c) Describe the most crucial heat related illness
(4 marks)
- Q2**
- (a) There are two basic approaches we can take to evaluate thermal comfort; qualitative approach where we may not take any measurements but rely on other forms of evidence (i.e. interview, questionnaire). Quantitative approach where we carry out physical measurements. Give arguments on which is the best approach to use when people are complaining about feeling too hot or cold?
(8 marks)
- (b) Assemble the combination of the skin temperature, sweat production and the body's energy balance to derive the comfort equation.
(8 marks)
- (c) Explain on the constrain of adaptive approach in working requirement by giving appropriate example.
(4 marks)

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- Q3** (a) Distinguish the relation between level of humidity in the environment and the evaporation of the sweat from the body with proper elaboration. (8 marks)
- (b) You are in charge of health and safety at a job site. For each of the following workplace scenarios in **Table Q3(b)**, select the range of screening threshold limit value (TLV) and action limit (AL) according to its risk of exposure based on Malaysian Guidelines on Heat Stress Management at Workplace 2016.

Table Q3(b)

No.	Scenarios	Screening TLV (°C)	Screening AL (°C)	Risk of Exposure
1	Continuous, light work			Low
2	27% work and 73% rest, very heavy work			Low
3	48% work and 52% rest, moderate work			Medium
4	68% work and 32% rest, heavy work			Medium
5	17% work and 83% rest, moderate work			High
6	35% work and 65% rest, very heavy work			High

(12 marks)

- Q4** (a) Justify the importance to have a good balance in indoor air quality, thermal comfort and energy usage in designing ventilation system. (10 marks)
- (b) **Figure Q4(b)** shows the traditional and modern house in Malaysia. Give your opinion on which one of these building have healthier indoor air quality? (10 marks)

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- Q5** (a) You had been hired as the heat stress assessor for the steel mill in Johor Bahru. Five workers of the steel mill worked in the casting section daily from 8.00 am until 5.00 pm. The steel mill management received an employee complaint regarding heat stress in the casting section. The complaint alleged that employees were working in hot temperature cause by the radiant heat of the industrial furnace from the adjacent section. 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 steel mill management with appropriate elaboration.

(12 marks)

- (b) Differentiate these four factors that influence person's adaptation from heat

- (i) Medical conditions;
- (ii) general physical health factors;
- (iii) age; and
- (iv) body fat

(8 marks)

- Q6** You have been hired as an indoor air quality assessor for a hospital that was built in 2004. The hospital suffers from mould contamination. Meeting had been conducted and the hospital shows several pictures on the existing condition of the hospital building. Surface stains and visible microbial growth are found on wall surfaces, ceiling boards, floor and furniture. Moisture condensation is quite prevalent on various surfaces like glass panes, metal door frames and walls. Water is found dripping down from the soaked ceiling boards through the wall onto the floor at many locations.

- (a) As the indoor air quality assessor, propose method for indoor air quality investigation and assessment that you will conduct.

(10 marks)

- (b) Propose general solutions on improving the indoor air quality in the hospital based on the existing condition of the hospital.

(10 marks)

- END OF QUESTION -

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DESIGN



Traditional house



Modern house

Figure Q4(b)

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