

SUPERVISOR DECLARATION

“I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (with Honours)”

Signature: _____

Supervisor: DR.TEE BOON TUAN

Date: _____

**IMPROVEMENT OF AN INDOOR ENVIRONMENTAL QUALITY (IEQ) IN
ENGINEERING LABORATORIES**

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in fulfilment of the requirements for the degree of
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DECLARATION

“I hereby declare that this project report entitled “Improvement of an Indoor Environmental Quality of Engineering Laboratories” is my own work except as cited in the references.”

Signature: _____

Name : CHONG HONG LEONG

Date : _____

DEDICATION

For my beloved Dad and Mum

ACKNOWLEDGEMENT

First, I would like to express my special thanks of gratitude to my supervisor Dr. Tee Boon Tuan for his patient guidance along this project. I am highly benefited by this project and gained a lot of knowledge about the various analysis conducted to evaluate indoor environment quality.

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ABSTRACT

Indoor environment conditions of a building are one of the concerned issues as people usually spend most of their time inside the buildings. Poor indoor environmental conditions can influence human health in terms of physiological, perceptual and emotional as well. The main objective of this study is to determine the indoor environment condition of engineering laboratories in Mechanical Engineering Laboratories Complex. Thermal comfort analysis and indoor air quality analysis were conducted to evaluate the indoor environment quality of the laboratories. Analysis consists of physical measurement and subjective measurement. Physical measurements were conducted with occupancy and no occupancy condition while subjective measurement was carried out through questionnaire. Results show that air-conditioned machine workshop has temperature of 20.8°C which is not within the MS 1525:2014 standard but still acceptable by occupants. Meanwhile, the thermal condition of non-air conditioned welding workshop is not complied with ASHRAE Standard 55:2010 in terms of air temperature, PMV and PPD index. In addition, result from occupant's air odor perception indicates that air odor problem occurred in both case study areas. Based on the findings, indoor environment quality improvement measures are proposed to enhance the IEQ level of the laboratory.

ABSTRAK

Keadaan persekitaran dalaman bangunan merupakan salah satu isu yang diberi perhatian kerana orang biasanya menghabiskan sebahagian besar masa mereka di dalam bangunan. Keadaan persekitaran dalaman yang teruk boleh mempengaruhi kesihatan manusia dari segi fisiologi, persepsi dan juga emosi. Objektif utama kajian ini adalah untuk menentukan keadaan persekitaran dalaman makmal kejuruteraan Kompleks Makmal Kejuruteraan Mekanikal. Analisis keselesaan termal dan analisis kualiti udara dalaman dijalankan untuk menilai kualiti alam sekitar dalaman di makmal. Analisis terdiri daripada pengukuran fizikal dan ukuran subjektif. Pengukuran fizikal dijalankan dengan penghuni dan tiada keadaan penghuni manakala pengukuran subjektif dilakukan melalui soal selidik. Hasil kajian menunjukkan bahawa bengkel mesin berhawa dingin mempunyai suhu $20.8\text{ }^{\circ}\text{C}$ yang tidak mencapai Piawaian MS 1525:2014 tetapi masih dapat diterima oleh penghuni. Sementara itu, keadaan termal bagi bengkel kimpalan yang tidak berhawa dingin tidak mematuhi Piawaian ASHRAE 55:2010 dari segi suhu udara, indeks PMV dan PPD. Selain itu, hasil daripada persepsi bau udara penghuni menunjukkan bahawa masalah udara berbau berlaku di kedua-dua tempat kajian kes. Berdasarkan penemuan ini, langkah-langkah untuk memperbaiki kualiti alam sekitar dalaman dicadangkan untuk meningkatkan kualiti alam sekitar dalaman makmal.

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LIST OF SYMBOLS

SYMBOLS	DESCRIPTION
°C	Degree Celsius
°F	Fahrenheit
K	Kelvin
m	Metre
mm	Millimetre
s	Seconds
%	Percent
W	Watt
m/s	Velocity
ppm	Parts-per-million
cfm	Cubic feet per minute
R ²	Coefficient of determination
L/s	Litre per second

LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
A	Afternoon Session
AV	Air Velocity
AOV	Air Odor Vote
ACMV	Air-Conditioning and Mechanical Ventilation
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
CLO	Clothing Insulation Value
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DOSH	Department of Occupational Safety and Healthy
EEL	Engineer Education Laboratories
IAQ	Indoor Air Quality
IEQ	Indoor Environmental Quality
ISO	International Organization of Standardization
M	Morning Session
MS	Malaysia Standard
PM	Particular Matter
PMV	Predicted Mean Vote
PPD	Predicted Percentage of Dissatisfied
RH	Relative Humidity

ABBREVIATION	DESCRIPTION
SBS	Sick Building Syndrome
TSV	Thermal Sensation Vote
UTeM	Universiti Teknikal Malaysia Melaka
WHO	World Health Organization

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